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REPORT ON

CONDITIONS OF EMPLOYMENT IN THE IRON AND STEEL INDUSTRY

IN THE

UNITED STATES

IN 4 VOLUMES

VOLUME III: WORKING CONDITIONS AND THE RELATIONS OF EMPLOYERS AND EMPLOYEES

Prepared under the direction of
CHAS. P. NEILL
Commissioner of Labor

WASHINGTON
GOVERNMENT PRINTING OFFICE
1913

IN THE SENATE OF THE UNITED STATES,
August 21, 1911.

Resolved, That the report of the Secretary of Commerce and Labor concerning the conditions of employment prevailing in the iron and steel industry of the United States, submitted in compliance with Senate resolution numbered Two hundred and thirty-seven, Sixty-first Congress, second session, be printed, with accompanying illustrations, as a public document.

Attest:

CHARLES G. BENNETT,
Secretary,
By HENRY H. GILFRY,
Chief Clerk.

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CONTENTS.

Page.

Letters of transmittal 9, 10

Introduction and summary 11–26

  Scope and method 13, 14

  Underlying causes of existing working conditions 14

  The industry and its workmen 14, 15

  Plans for the elimination of the 7-day week and 12-hour day 15–20

    Results and costs 15, 16

    Advantages of the 8-hour system 17

    Cost of the 8-hour day 17, 18

    Maximum cost of change to 8-hour day 18

    Probable cost of change to 8-hour day 18–20

  Overtime and extra Sunday work 20, 21

  Irregularity of employment 21, 22

  Opportunities for annual earnings 22, 23

  Wages and the cost of living 23

  Earnings of workmen of the United States Steel Corporation, large independent companies, and small companies 23, 24

  Efficiency and physical conditions 24, 25

  Conditions peculiar to localities and to particular companies 26

Chapter I.—Extent and organization of the industry 27–40

  Consolidation of the industry and its effects on the employment of labor .. 30–33

  Increases in production and changes in character of products 33–38

  Present geographical distribution of the industry 38–40

Chapter II.—The modern steel works 41–76

  Introduction 43, 44

  Blast furnaces and docks 44–48

  Bessemer department 49, 50

  Open-hearth department 50–54

  The ingot stripper 54, 55

  Rolling mills 55–74

    Mechanical mills 58–66

      Blooming mills 58–62

      Rail, structural, and other shape mills 62, 63

      Billet and sheet bar mills 63, 64

      Slabbing and plate mills 64–66

    Hand mills 66–74

      Bar and guide mills 67–72

      Rod mills 72–74

  Auxiliary departments 74–76

Chapter III.—The workmen 77–105

  General organization of labor force 79–83

  Racial composition of labor force 83–90

  Racial displacements in the past thirty years 90–93

  Ability to speak English 93–96

  Age distribution 96–100

  Experience of immigrants before entering the steel industry 100–102

  Conjugal condition of employees and size of family 102–105

Page.

Chapter IV.—The relations of employers and workmen 107–156
  Introduction 109–111
  Labor organizations prior to formation of the Steel Corporation 111–116
  Labor organizations under the Steel Corporation, 1902 to 1911 116–136
  Present relations of employers and workmen 136–149
    The United States Steel Corporation 137, 138
    The large "independent" companies 138–140
    Methods of employing workmen 140–149
      Operations of employment bureau in a representative plant .. 141–144
      Conditions in other plants 145, 146
      The "petty graft" of foremen 147–149
  Relations of employers and union workmen 149–156
    Membership of union 149–151
    Method of fixing wage scales 152–154
      Continuous operation agreement 152, 153
      The sliding scale 153, 154
    Attitude toward nonunion workmen 154–156

Chapter V.—Plans for eliminating the 7-day week and the 12-hour day: Results and costs 157–192
  Introduction 159
  Working hours in 1912 159–164
    Report of committee of stockholders of the United States Steel Corporation 161, 162
    Resolutions of the finance committee of the United States Steel Corporation 162
    Resolutions of the Special Commission on Hours of Labor in Continuous Industries 162–164
  Reasons for continuous operation 164–166
  Plans for the elimination of 7-day work 166–171
  Plans for the elimination of 12-hour work 171–175
  Cost of the 8-hour day 175–187
    Maximum cost of change to the 8-hour day 177–181
      Blast furnaces 177, 178
      Blast furnaces, steel works, and rolling mills 179–181
    Probable cost of change to the 8-hour day 181–187
      Blast furnaces 183, 184
      Blast furnaces, steel works, and rolling mills 184–187
  Actual results of the 8-hour system in a steel foundry 187–192

Chapter VI.—Overtime work 193–202
  Introduction 193
  Frequency and amount of overtime work 193–198
  Overtime work on Sunday 198, 199
  Payment for overtime work 199–201
  Extreme cases of overtime work 201, 202

Chapter VII.—Irregularity of employment 203–214
  Introduction 205, 206
  Fluctuations in pig-iron production 207
  Fluctuations in employment in blast furnaces, 1907 to 1911 207–210
  Fluctuations in employment in steel works and rolling mills 210–212
  Opportunities for employment, 1910 212–214

Chapter VIII.—Annual earnings as affected by irregular employment 215–228
  Introduction 217
  Full-time weekly earnings 217, 218
  Opportunities for annual earnings 218–221
  Opportunities for annual earnings in the several departments 221–223

Page.
Chapter VIII.—Annual earnings as affected by irregular employment—Conc'd.
Opportunities for annual earnings in the several districts 223–228
Blast furnaces 224
Bessemer converters 225
Open-hearth furnaces 225, 226
Rolling mills 226-228
Mechanical rolling mills 227
Hand rolling mills 227, 228
Chapter IX.—Trend of wages, 1900 to 1910 229–258
Introduction 231, 232
Hourly wage rates, 1900 to 1910, all classes of labor 232–250
Blast furnaces 237–240
Bessemer converters 241, 242
Open-hearth furnaces 242–244
Blooming mills 245, 246
Bar mills 246, 247
Rod mills 248–250
Hourly wage rates, 1901 to 1910, common labor 251, 252
Tonnage rates, earnings, and output of tonnage workers, 1900 to 1910 ... 252–258
Chapter X.—Comparison of earnings of workmen of the United States Steel Corporation, large independent companies, and small companies 259–267
Chapter XI.—Relation of wages to profits and costs 269–286
Introduction 271
Relation of wages to profits 271–280
United States Steel Corporation 272–277
Republic Iron & Steel Co 278–280
Relation of labor cost to the total cost of production 280–286
Works labor costs 280–283
Total labor costs 283–286
Chapter XII.—Working conditions and efficiency, as affected by heat 287–332
Introduction 289–292
Temperature conditions in blast furnaces, steel works, and rolling mills. 292–332
Character of records obtained 292–294
Blast-furnace department 295–301
Top fillers 297, 298
Casting crew 298, 299
Iron breakers and carriers 299, 300
Stove cleaning, boiler rooms, and slag disposal 300, 301
Bessemer department 301–306
Cupola men 304
Vessel men, etc 304, 305
Pitmen 305
Ladle men and platform men 305, 306
Open-hearth department 306–317
Temperature readings in principal working zones 309–311
Temperature readings for principal occupations 311–317
Puddling mills 317–319
Rolling mills 319–328
Blooming and slabbing mills 319–325
Plate mills 325–327
Bar and other small mills 328
Tube mills 328–332
Chapter XIII.—Working conditions and efficiency as affected by the speed and severity of the work 333–376
Introduction 335–339

Chapter XIII.—Working conditions and efficiency as affected by the speed and severity of the work—Concluded. Page.
Blast-furnace department........ 339-346
Increases in productive efficiency........ 339-344
Actual working time and intensity of work........ 344-346
Comparative English and American conditions........ 346
Bessemer department........ 346-352
Increases in productive efficiency........ 346-351
Actual working time and intensity of work........ 351, 352
Open-hearth department........ 352-355
Increases in productive efficiency........ 352-354
Actual working time and intensity of the work........ 354, 355
Comparative English and American conditions........ 355
Rolling mills........ 355-375
Mechanical rolling mills........ 356-363
Increases in productive efficiency........ 356-360
Actual working time and intensity of work........ 360-362
Comparative English and American conditions........ 362, 363
Hand rolling mills........ 363-375
Increases in productive efficiency........ 363-372
Development of equipment........ 373-375
Tube mills........ 375, 376
Increases in productive efficiency........ 375, 376
Chapter XIV.—Relation of unsteady employment, low wages, long hours, and night work to productive efficiency........ 377-384
Unsteady employment and shifting character of the labor force........ 379-381
Low wages and inefficiency........ 382, 383
Relation of long hours and night work to efficiency........ 383, 384
Chapter XV.—Time and method of wage payments........ 385-414
Introduction........ 387
Frequency of wage payment........ 387-392
Advances on wages........ 392-394
Cash checks........ 392, 393
Purchase and sale of store orders........ 393, 394
Deductions from wages........ 394-404
Disablement funds........ 394-398
Medical fees........ 398, 399
Deductions for company stores and company houses........ 399-401
Minor deductions........ 401, 402
Ice water........ 401
Identification checks........ 401, 402
Fines, etc........ 402
Effect of deductions........ 402-404
Indirect additions to wages........ 404-414
Bonus plans........ 406-414
Blast furnaces........ 406-408
Steel works and rolling mills........ 409
Skelp mills........ 409, 410
Pipe mills........ 410
Tube mills........ 411, 412
Open-hearth furnaces........ 412-414
Chapter XVI.—Company houses and company stores........ 415-451
Introduction........ 417, 418
Company houses........ 418-420

Chapter XVI.—Company houses and company stores—Concluded. Page.
Company houses in important steel towns 420–443
  Community A, Eastern district 420–426
    Housing of officials and skilled workmen 421–423
    "Shanties" of the unskilled workmen 423–426
  Community B, Eastern district 426–428
  Community C, Pittsburgh district 428–432
  Community D, Alabama 432–435
    White quarters 433–435
    Negro quarters 435
  Community E, Great Lakes district 436, 437
  Community F, Great Lakes district 437–443
Company houses in small isolated communities 443–445
  Community G, Alabama 443
  Community H, Alabama 444
  Community I, Tennessee 444
  Community J, Tennessee 445
  Community K, Virginia 445
Company stores 445–451
Chapter XVII.—Pension funds, profit-sharing plans, and plant and community sanitation 453–472
Introduction 455
Pension funds 455–461
  Pension system of the United States Steel Corporation 455–459
  Pension system of the Wisconsin Steel Co 459–461
Profit-sharing plans 461–469
  The sliding scale 462
  Profit-sharing plan of the Youngstown Sheet & Tube Co 462, 463
  Profit-sharing plans of the United States Steel Corporation 463–469
    The bonus fund 464
    The stock-subscription plan 464–469
Improvement of plant sanitation 469–471
Community sanitation 471, 472
Appendixes 473–584
Appendix A.—Distribution of iron and steel production, by States 475–478
Appendix B.—Distribution of steel plants, by size of communities in which located 479
Appendix C.—Characteristics of the labor force of a representative steel plant 480–496
Appendix D.—Extracts from minutes of executive committee of United States Steel Corporation 497–506
Appendix E.—Affidavits presented by the American Federation of Labor regarding action of United States Steel Corporation during the tin-plate strike of 1909 507–509
Appendix F.—Character and severity of the work in productive occupations in 1895 and in 1910 510–532
Appendix G.—Detailed exhibit of working hours in a representative steel plant 533–540
Appendix H.—Plans for the elimination of 7-day work 541–547
Appendix I.—Opportunities for work in the iron and steel industry during 1910 .... 548, 549
Appendix J.—Full time weekly earnings of employees 550–558
Appendix K.—Opportunities for annual earnings during 1910 559–573
Appendix L.—Rates paid common laborers, 1901 to 1910 .... 574, 575
Appendix M.—Tonnage rates, average earnings, and output of tonnage workers in representative plants, 1900, 1905, and 1910 576–581
Appendix N.—Announcement of United States Steel Corporation's stock subscription plan for 1912 582–584

LETTERS OF TRANSMITTAL

Department of Commerce and Labor,
Office of the Secretary,
Washington, August 19, 1912.

Sir: In partial compliance with Senate resolution 237 of June 23, 1910, I have the honor to transmit herewith a report dealing with working conditions and relations of employers and employees in the iron and steel industry in the United States, being Volume III of the Report on Conditions of Employment in the Iron and Steel Industry in the United States.

The resolution in response to which these data are transmitted reads as follows: "*Resolved*, That the Department of Commerce and Labor, through the Bureau of Labor, be, and is hereby, directed to investigate and report to the Senate as early as possible as to the conditions of employment prevailing in the iron and steel industry of the United States, with the details concerning the wages paid, the hours of labor per day and the number of days' labor per week, and the number employed."

Respectfully,
Charles Nagel,
Secretary.

Hon. James S. Sherman,
President of the Senate, Washington, D. C.

Department of Commerce and Labor,
Bureau of Labor,
Washington, August 19, 1912.

Sir: I beg to transmit herewith Volume III of the report embodying the results of the investigation into the conditions of employment prevailing in the iron and steel industry in the United States, which was undertaken in compliance with Senate resolution 237 of June 23, 1910.

This section of the report deals with working conditions and the relations of employers and employees. The general investigation has been carried on under the immediate direction of Mr. G. W. W. Hanger, chief statistician of the Bureau. The field work was carried on by groups of special agents under the immediate direction of Special Agents N. C. Adams, F. W. Bird, Basil M. Manly, and W. B. Palmer, respectively. The assembling, the analyzing, and the presentation of this material in this volume have been the work of Special Agent Basil M. Manly. In this work Mr. Manly has been assisted by Special Agents Thomas A. Bartley, F. W. Bird, and B. C. Washington, jr. Mr. Hugh S. Hanna, of the editorial division of the Bureau, gave valuable assistance in the preparation of the text.

I am, very respectfully,

CHAS. P. NEILL,
Commissioner.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

INTRODUCTION AND SUMMARY.

INTRODUCTION AND SUMMARY.

In the two preceding volumes of this series a very detailed statistical presentation of the wages and hours of labor existing in the iron and steel industry in 1910 has been made, accompanied by a concise but accurate statement of the nature of the work required of the workmen in the various occupations. No attempt was made in those volumes to do more than set forth the facts as to the wages paid and the customary working time in the industry.

SCOPE AND METHOD.

The purpose of the present volume is twofold. First, to set forth the facts with regard to the most important phases of the working conditions in the industry, with the exception of the occurrence and prevention of industrial accidents, which is reserved for separate treatment in Volume IV; second, the attempt is made with respect to those conditions which seem particularly undesirable to show what has been done and what reasonably may be done to improve them. In the discussion of the 12-hour day, for example, the results of the most important experiments with the 8-hour system are set forth, and in addition certain facts are presented to show the probable cost of the substitution of three shifts of 8 hours each for the existing two shifts of 12 hours.

In the collection of the material on which this report is based more than 100 plants in different parts of the country were visited by agents of the Bureau. In a number of these plants the agents spent two or more weeks inside the mills, to which they were given access at all hours of the day and night. This time was spent largely in a careful study of the physical conditions connected with the work, much valuable and exact data, such as the records of the temperatures to which workmen are exposed, being collected in this manner. In addition a large amount of statistical information was secured by the agents from the records of the companies, which forms the basis of several of the chapters. It is proper to state that with few exceptions the agents of the Bureau were given full opportunity to make a thorough investigation, and such information as was requested was supplied promptly.

The investigation did not attempt to cover the housing and living conditions of the iron and steel workers, except in so far as these conditions were directly under the control of the steel company through the ownership of the houses and stores or of the water, light, and other public-service companies. The general living conditions in the principal "steel towns" were exhaustively studied by the Immigration Commission in 1908. Such conditions change very slowly, and a second investigation of them, even as late as 1912, would undoubtedly have found the housing and living conditions practically the same as in 1908.

UNDERLYING CAUSES OF EXISTING WORKING CONDITIONS.

The iron and steel industry is characterized by three features which, either singly or in combination, are largely responsible for the existing working conditions. In the first place, the industry is concerned with the manufacture and handling of large masses of molten or highly heated metal involving the continuous day and night operation of the producing departments and the exposure of many of the workmen to high temperatures and very hazardous conditions. Second, the industry is organized in very large units as regards both the ownership and the size of the manufacturing plants. Third, the majority of the labor force consists of relatively unskilled laborers, recruited from the ranks of the recent immigrants, who are generally accustomed only to rural conditions and farm work, and a large proportion of whom neither speak nor understand the language of the foremen and skilled workmen responsible for their direction and supervision.

The relation of these fundamental characteristics of the industry to the various working conditions will be developed in the course of the discussion, but it can not be too strongly emphasized that they must be kept clearly in mind in examining any phase of the industry.

THE INDUSTRY AND ITS WORKMEN.[1]

The iron and steel industry, as treated in the present report, includes only the blast furnaces, steel works, and rolling mills, together with their auxiliary departments. As such it has a capitalization of more than a billion and a half dollars and employs in the neighborhood of 300,000 men. The majority of this capital and the large number of these workmen are under the control of a very few corporations of great size. More than 99 per cent of the iron and steel products were manufactured in, and practically an equal proportion of the workmen are employed by, establishments owned by corporations. The ultimate employers of these 300,000 workmen are, therefore, the stockholders in these corporations. These stockholders are many thousand in number and, scattered as they are throughout the

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[1] For detailed data and discussion see Chapters I, III, and IV.

United States and Europe, they exercise little control over the corporations which they own, and manifest scarcely any feeling of responsibility for the conditions under which their employees work. The men in direct control of these corporations are the presidents and managers, whose success is gauged almost entirely by the condition of the balance sheet and the regularity of the dividends. Their immediate self-interest and natural inclination, therefore, lie in the establishment and maintenance of only those working conditions from which a sure and immediate profit can be foreseen.

The workmen, furthermore, have no effective means of determining the conditions under which they work or even of calling attention to the features which they consider unjust. Apart from the fact that a very large number of the workmen can not make themselves understood either by their superior officers or by many of their fellow workmen, they are almost entirely without organization, through which alone demands and protests can be made effective. The Amalgamated Association of Iron, Steel, and Tin Workers, it is true, still exists, but it has been so weakened by its contests, first with the Carnegie Steel Company and later with the United States Steel Corporation, that it possesses little strength, except in a very narrow field. The membership of the association is drawn almost entirely from among the skilled workmen in the puddling mills, the small rolling mills, and the independent sheet and tin mills. The large steel mills, therefore, are practically unrepresented in its membership. There is at present no open organization of iron or steel workers in any of the subsidiary companies of the Steel Corporation, and in only two of the large "independent" companies does such organization exist.

With such a preliminary understanding of the character of the industry and its workmen and of the existing relations between the employers and employees, it is possible to present a brief résumé of the principal features of the working conditions.

PLANS FOR THE ELIMINATION OF THE 7-DAY WEEK AND 12-HOUR DAY.

RESULTS AND COSTS.[1]

In Volume I of this report stress was laid upon the existence of a schedule of unusually long working hours in the iron and steel industry as compared with other lines of work. It was shown that in May, 1910, the normal working day for the majority of the steel workers was 12 hours long, with a periodic change from day to night shift, and that a very large proportion of the entire force (29.3 per cent) regularly worked 7 days per week, and were required to be on duty continuously for from 18 to 24 hours when the shifts were changed from day to night work. The undesirable effects of such a schedule of working hours upon the individual workmen and indirectly upon the community at large were also pointed out in that volume.

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[1] For detailed data and discussion see Chapter V.

Since the publication of Volume I a number of the steel companies, notably the United States Steel Corporation, have put into effect various plans by which none of their employees is required or permitted to work more than 6 days per week. Between 40 and 50 per cent of the employees formerly working 7 days per week have been affected by these arrangements for 6-day work, but this still (August, 1912) leaves more than 15 per cent of the employees in the industry as a whole and more than 50 per cent of the blast-furnace workmen on a regular schedule of 7 days a week, with a long turn of 18 or 24 hours at the change of shift. Furthermore, the proportion of men working 12 hours a day has been practically unchanged.

It is the general opinion of the workmen that these arrangements for six days of work per week have not secured to them any advantages commensurate with the loss of one day's pay each week. The day of enforced rest[1] does not ordinarily give them a holiday either on Sunday or on any other day on which their fellow workmen are also at leisure. On any day except Sunday, the workmen say, there is nothing to do; their friends are in the mills, their children are at school, and their wives are busy with their regular household duties. There is nothing to interest them at home, and there is nothing to do except to sleep all day or go to the saloons. Finally, most of the workmen interviewed stated that the hardship of the conditions consisted not so much in having a schedule of seven days a week, for a man could usually get a day off now and then, but in being on duty for 12 hours a day, with an additional hour lost in going to and from work.

During the past year, 1911–12, definite recommendations have been made for the elimination of the 12-hour day by two important bodies, the stockholders' committee of the United States Steel Corporation and an international conference under the auspices of the International Association for Labor Legislation.[2] The only practicable substitute for the existing schedule of two shifts of 12 hours each is that of three shifts of 8 hours each. All of the producing departments of a steel plant must be operated day and night with no interruption between the shifts in order to secure successful operation. Such an arrangement as the gradual reduction to 9 or 10 hours per day is impossible for the workmen in the productive occupations.

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[1] See detailed discussion of these plans in Chapter V.

[2] See pp. 161–164.

ADVANTAGES OF THE 8-HOUR SYSTEM.

In addition to being the only practical substitute for the 12-hour system of working hours, the 8-hour system possesses certain definite advantages, chief among which are the following:

1. It gives the workman time for complete physical recuperation, companionship with his family, self-improvement, and leisure even when employed 7 days a week.
2. From the experience of English blast-furnace owners who have adopted the 8-hour shift system, and from the experience in other industries, it will tend to produce a much more efficient force of workmen.
3. It affords a much more flexible working system than exists with the present schedule of working hours, particularly when the schedule of working time is affected by any of the highly complex systems of relief men for the elimination of 7-day work.
4. The 8-hour shift system can be introduced gradually and does not require a complete revolution of operation as did the plans for the elimination of 7-day work. In fact, in so far as the 8-hour shift system has as yet been introduced in the rolling mills it has come about by gradually placing the most strenuous occupations on an 8-hour shift system. In many mills at the present time men are working 12-hour and 8-hour turns side by side without any interference with the efficient operation of the mills.
5. It effectually prevents the existence of "long turns" of 24 or 18 hours, except under the unusual conditions in which long-continued work by certain special men is necessary for the preservation of property or to permit interrupted operations to be resumed.
6. It gives a workman much more time for the performance of his religious duties than the majority of the plans for the elimination of 7-day work.

COST OF THE 8-HOUR DAY.

The principal objection of the employers to the adoption of the 8-hour system is that considerable increases in the hourly rates of wages would have to be made, resulting, they assert, in a higher cost of production. Some increase in the rates of wages will undoubtedly be necessary. The workman will not, and in fact can not, accept an 8-hour day at the same hourly rate now paid for 12 hours, for this would mean a reduction of one-third in his daily earnings. The average earnings of the employees in the productive occupations of the iron and steel industry are 22.3 cents per hour, or $2.68 for 12 hours' work. For 8 hours' work per day at that rate only $1.78 would be received, or 12 cents per day less than the common laborers now average for a 12-hour day.

It is possible, of course, that with the hours of labor reduced the workman's efficiency would increase sufficiently to compensate for a very considerable increase in his hourly rate. Such, indeed, was the result in the case of the companies whose experience with the 8-hour day is known, and, as will be brought out fully in Chapter V, some increase in efficiency is to be expected in all such cases, even though the increased efficiency may not compensate in full for the increased rates of wages. As, however, it is impossible to foretell with any accuracy the influence of shorter hours on efficiency, the estimates as to the cost of introducing the 8-hour day which appear in Chapter V are made on the assumption that efficiency would not be affected by the change.

Two sets of estimates are presented. They seek to determine, respectively:

(1) The maximum cost, arrived at on the assumption that hourly rates are so increased that the daily earnings of the workman would be the same as before.

(2) The probable cost, arrived at on the assumption, which experience and interviews with employees have shown to be sound, that a satisfactory compromise was made by paying the workmen for 8 hours' work the same amount per day that they would receive at the present hourly rates for working 10 hours per day; in other words, an increase of 25 per cent in the present hourly rates.

The method of arriving at these estimates is shown in detail in Chapter V.

MAXIMUM COST OF CHANGE TO 8-HOUR DAY.

The estimates show that the increase in the cost of production of a ton of pig iron would be only 2.6 per cent of its present cost if the workmen were paid the same wages for 8 hours that they now receive for 12 hours and if absolutely no variation in efficiency followed the change. Similarly the maximum increase in the cost per ton of the principal products of the steel works and rolling mills would be only 6 per cent. The reason for the small increase in the cost of production as compared with the assumed increase of 50 per cent in the hourly rates of wages lies in the fact that labor constitutes only a very small part of the cost of production. In the production of pig iron labor constitutes only 6.4 per cent of the total cost and for the five principal products of the steel works and rolling mills only 17.1 per cent of the total cost.

PROBABLE COST OF CHANGE TO 8-HOUR DAY.

If the workmen were given an increase of 25 per cent in the hourly rate of wages at the time of the change to the 8-hour system instead of the 50 per cent assumed in the preceding discussion, the increase in the cost of production per ton of pig iron would be only 1.3 per cent and in the cost of the principal steel products only 3 per cent, even if no change in the efficiency of the workmen occurred as a result of the change.

There is, however, every reason to expect that an increase in efficiency sufficient to at least offset this estimated increase in cost would follow the adoption of the 8-hour system. As a basis for this statement there is not only the experience in other industries, but in the iron and steel industry there are the statements of the British blast-furnace owners and the conclusive results of tests of the 8-hour system in American steel plants.[1] These tests have shown that there is not only no increase in the cost of production, but that where the success of the process can be readily affected by the attention and physical condition of the employees the quality of the product has been greatly improved as a result of the shorter working hours and numerous immediate economies have been effected which more than compensate for the cost of the change.

In considering the change to the 8-hour system the question of labor supply must necessarily receive attention. It is asserted by some of the steel manufacturers that the lack of an adequate additional force to form the third shift of workmen, required by the change, renders the change to the 8-hour system difficult if not impracticable. Several facts should, however, be considered in this connection. In the first place, the men working 12 hours at present constitute about one-half of the labor force, and consequently if there were no increase in efficiency the additional workmen required by the 8-hour system would equal not more than one-fourth of the present force. Experience has shown, however, that certain readjustments may be made in changing to the 8-hour system by which certain marked economies in the necessary number of men may be effected.[2] It would seem probable on the basis of this experience that the additional force required would not be more than one-fifth of the present force. Second, the workmen of the steel industry are at present recruited almost entirely from the ranks of the newly arrived immigrants, the number of whom increases or decreases almost directly in proportion to the demand for labor in this country. Third, it is shown in another part of this volume that even during the prosperous year of 1910 the average workman lost about 7 weeks, or 13 per cent of the total time, through the shutting down of the department or mill in which he was employed. Similarly, in the census year of 1909 the minimum number of employees in the steel works and rolling mills was 24.2 per cent smaller than the maximum number employed during that year. The elimination of this great irregularity of operation would make it possible to turn out the same amount of product with a smaller force, and would thus provide indirectly for the additional workmen required for the change to the 8-hour system. Finally, the adoption of the 8-hour system would, it seems, render the work in the industry more attractive and thus induce a larger number of workmen to seek employment. The president of the National Tube Co., in a letter to the secretary of the American Iron and Steel Institute, wrote with regard to blast-furnace conditions: "There has been a marked decrease in the intelligence of these employees (i. e., blast-furnace workmen) during the past 12 or 15 years, largely, we believe, because intelligent men did not wish to work 7 days every week, and therefore sought employment in other departments."[1] Many of the workmen and foremen interviewed said that the ablest and best-trained men in the steel works and rolling mills were leaving the steel industry when opportunity offered, to avoid the 12-hour day, the frequent overtime, and the great irregularity of work.

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[1] See pp. 172–175, 187–192.

[2] See Chapter V, especially pp. 185, 186.

OVERTIME AND EXTRA SUNDAY WORK.[2]

The adoption of a more reasonable schedule of working hours is rendered particularly desirable by the existence in the iron and steel industry of frequent overtime work. For a man to be called upon at the end of a 12-hour day to take the place of an absent workman or to assist in some repair work is a genuine hardship. This is not an infrequent occurrence, and the duration of such overtime often extends for 12 hours or more in addition to the regular working day.

A careful examination of the amount of overtime work at 9 large steel plants with a total of 38,000 employees showed that during the month of May, 1910, practically as much overtime and extra Sunday work was being done as at the Bethlehem Steel Works prior to the strike at that plant in February, 1910, which was caused largely by the frequency and extent of the overtime required.[3] It was found that in the 9 plants investigated 29.7 per cent of all the employees worked overtime and that such overtime work averaged 8.4 per cent of their regular working time. On the basis of 72 hours per full week this would be equivalent to 6 hours of overtime per week. Of the men engaged in mechanical repairs 58.1 per cent worked overtime for an average of 9.9 per cent of their regular working time. Most of these men worked either 72 or 84 hours a week regularly, and the addition of 7 or 8 hours per week constituted a considerable hardship. These conditions were not limited in any sense to the 9 plants under investigation, which were selected only because their records were in such condition that an accurate study could be made.

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[1] Hearings before Committee on Investigation of United States Steel Corporation, H. R., p. 3372.

[2] For detailed data and discussion see Chapter VI.

[3] See Report on Strike at Bethlehem Steel Works, South Bethlehem, Pa., S. Doc. No. 521, 61st Cong., 2d sess., 1910, pp. 14 and 15.

As an underlying cause of the existence of so large an amount of overtime work it was found that with a very few exceptions no additional compensation above the regular rate is paid for overtime or extra Sunday work to the employees of the productive departments and that only 5.6 per cent of the power, mechanical, and yard force received a higher rate for overtime than for their regular work.

IRREGULARITY OF EMPLOYMENT.[1]

It might be expected that in an industry where there was so much pressure for Sunday and overtime work there would be constant employment throughout the year. As a matter of fact, however, the iron and steel industry is more irregular in its operation and shows greater fluctuations in its labor force during the course of the year than any of the large manufacturing industries whose demand is not seasonal. This high degree of irregularity of employment was the subject of more frequent complaint on the part of the workmen interviewed than any other condition connected with the industry. Some of the managers and superintendents also consider it one of the greatest obstacles to securing a highly efficient working force.

Both the overtime work and the irregularity of operation are in large part results of the same cause, which is one of the fundamental policies in the present day management of the industry. This policy consists in running a department at top speed and under the heaviest pressure while there is an active demand for its particular products and then shutting it down as soon as the market becomes weak. During these periods of heavy pressure the production is large and the immediate costs frequently are far below normal, presenting a fine showing for the mill when only a single month's cost sheets are considered. When the mill is shut down, however, not only do the heavy fixed charges continue and the machines depreciate, but the workmen lose their skill and efficiency rapidly and the working organization is frequently injured by the loss of the best workmen who leave to seek places elsewhere. Some of the best managers assert that the losses from these causes more than counterbalance the gains secured during the months of rush work, and they are confident that they could make a better showing in economy of production for the year as a whole if the mills were operated regularly at a moderate pace.

The irregularity of employment constitutes a ground of complaint on the part of the employees not only because it considerably reduces their annual income, but because it makes it impossible for them to make or carry out any plans extending at all into the future. An investigation of the operating time during 1910, the year of largest steel production, showed that approximately 60 per cent of the employees were connected with departments or mills which were shut down for four or more weeks during the year. Almost 80 per cent of the employees in the hand rolling mills were connected with mills which were shut down for four or more weeks.

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[1] For detailed data and discussion see Chapter VII.

The greatest irregularity of employment, however, occurs in the case of the unskilled laborers who are employed in the performance of miscellaneous duties in the yards and auxiliary departments. These men work in gangs, the size and number of which vary from day to day according to the amount of work that needs to be done.

The effect of the irregularity of employment in the industry as a whole will be best understood when it is noted that instead of calculating the annual earnings of employees in the iron and steel industry on a basis of 52 weeks' employment it is necessary to make allowance for the fact that only 63 per cent were employed for as long as 44 weeks during the year. Furthermore, the above statements do not take into account any time lost through accident or sickness. The available statistics show that considering the steel industry as a whole each employee had an expectation of losing approximately 4 days a year through accidents[1] and at least 1½ weeks through sickness. Taking these various causes of unavoidable lost time into consideration it seems probable that during a prosperous year like 1910 the average employee does not have an opportunity to work more than 45 weeks during the year, and would therefore lose, through causes over which he could have no control, at least 13 per cent of the total working year. The reports of the Immigration Commission show how during the long periods of depression in the steel industry the families of steel workers are supported by the work of the women and children in cigar factories and other so-called "complementary" industries. These industries locate in the steel towns to take advantage of the large supply of woman and child labor which can not be utilized in the steel mills. As these factories are run with relative constancy, and are usually the only other industries in the steel towns which supply an outside market, it is largely through their assistance that the married employees are able to live through the long periods of depression. The unmarried immigrants in such cases leave the country in large numbers.

OPPORTUNITIES FOR ANNUAL EARNINGS.[2]

The necessity for such additions to the family income as have been described in the preceding paragraph will be understood when it is learned that in 1910 44 per cent of the employees in departments and mills operated more than 6 months during the year did not have an opportunity to earn as much as $600. Almost one-half of these employees, therefore, would have averaged less than $12 per week if they had worked every day their department was running during the prosperous year of 1910. Of the entire force in the producing departments (and this includes the rollers and other highly paid men of that class) only one-sixth had an opportunity to earn as much as $900 during the year. A very few workmen (1.5 per cent) might have earned $1,800 or more during the year.

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[1] See Accidents and Accident Prevention, Volume IV of this report.

[2] For detailed data and discussion see Chapter VIII.

In the blast furnaces it may be noted that only 32 per cent of the employees could have earned as much as $700 per year if they had worked 12 hours a day for 7 days a week all the time that their furnaces were in blast.

WAGES AND THE COST OF LIVING.[1]

During the past 10 years the wages of iron and steel workers have not increased at all proportionately to the cost of living. This can be most clearly seen in a study of the wages of unskilled laborers, which have been increased more largely in the last 10 years than those of any other class of workmen. During the 10 years, 1901 to 1910, the retail prices of food increased 32.8 per cent, while the hourly wages of unskilled laborers increased only 17.5 per cent.

During the same period the wages of other classes of workmen increased even less. A careful study of the wages paid in a number of important plants in 1900 and 1910 shows that not only was there in 1910 a smaller proportion of workmen paid the higher rates of wages, but in some cases the pay for the same work was actually less in 1910 than in 1900. Tonnage rates were in many cases very greatly reduced, but the rate of production by 1910 was generally sufficiently increased to give the employees higher daily earnings than in 1900. Some readjustment of wages to bring the higher and lower paid employees more nearly to an equitable basis was perhaps necessary, but the fact nevertheless remains that the food-purchasing power of the wages of 1910 was considerably less than that of the wages paid in 1900.

EARNINGS OF WORKMEN OF THE UNITED STATES STEEL CORPORATION, LARGE INDEPENDENT COMPANIES, AND SMALL COMPANIES.[2]

A comparison of the earnings of the employees of the United States Steel Corporation, the large "independent" companies, and the small companies shows that while the rates of wages paid unskilled laborers and other relatively low-paid employees are higher in the plants of the Steel Corporation than in other plants similarly located, there is very little difference between the three groups of companies as regards the earnings of the other classes of employees. In some of the departments the more highly skilled employees receive higher hourly wages in the plants of one group of companies, while in other departments the conditions are entirely different. Owing largely to the greater prevalence of the eight-hour day the large "independent" companies have a larger proportion of workmen earning the higher rates of wages (40 cents and over per hour) than either of the other groups of companies. However, much lower rates of wages are paid unskilled laborers in the plants of the large independent companies than in either of the other groups.

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[1] For detailed data and discussion see Chapter IX.

[2] For detailed data and discussion see Chapter X.

The average hourly earnings of the unskilled laborers in the blast furnaces of the Pittsburgh district were as follows: Steel Corporation, 17.1 cents; large companies, 15.9 cents; small companies, 16.3 cents.

EFFICIENCY AND PHYSICAL CONDITIONS.[1]

Practically all the labor problems of the steel industry are connected either directly or indirectly with the efficiency of the workmen. The development of an efficient force of workmen is one of the principal aims of every plant manager, but such a force can be secured only by attention to many factors which are too often overlooked. The relation of irregularity of employment to inefficiency has already been pointed out, and the probable lack of economy in the existing schedule of working hours has been suggested, but there are several other conditions which must be taken into consideration and carefully studied. Chief among these conditions are the physical surroundings of the men while at work and the character of the work which they perform. A special study of these physical conditions was made in the course of the present investigation, attention being directed principally to the temperatures to which the workmen are subjected in the performance of their duties and to the speed and severity of the work itself. The method of study was altogether comparative, because, even if the exact facts relative to the efficiency of men and machines is known, their significance can not be appreciated except by reference either to conditions in the past history of the same industry or to conditions existing at the same time in other comparable industries.

As a result of this study, two salient facts emerge: First, that every successful attempt to improve the physical conditions under which the work of making steel is done has resulted in increased efficiency of the workmen, and, second, that almost without exception every genuine advance in the art of steel making has improved the physical conditions under which the men work. This statement, it should be noted, does not mean that every increase in production has bettered the working conditions, for in many cases a great output has been secured only by subjecting the workmen to the most exhausting and undesirable conditions. It does mean, however, that the technical advances in steel production have been of such a character that they have tended to eliminate or greatly minimize the most undesirable conditions under which the work was formerly done.

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[1] For detailed data and discussion see Chapters XII, XIII, and XIV.

This result has not been at all a matter of chance, but has been the result of the soundest commercial motives. In order to secure men to perform the most severe and difficult work, it is necessary to pay very much higher than the ordinary wages, even though the work does not require a high degree of skill. Furthermore, since men can work only at low efficiency and for only a short time at exhausting labor or in debilitating surroundings, it is necessary to employ a very much larger force of men than would be required if the work were lighter or if it were done under conditions which could be borne without exhaustion throughout the whole working period. Consequently one of the most effective ways to decrease costs or to increase production is to eliminate from the work the elements which require this exhausting labor or to invent machines which will perform it. The efforts of the metallurgist and engineer, therefore, while primarily directed to lowering costs or to increasing production, have had the effect of improving the working conditions under which the labor in the steel industry is performed.

On the other hand, it frequently happens that the conditions which most seriously lower efficiency operate in such an indirect manner that they are not appreciated by the practical men in the industry. This was to a considerable extent true as regards the question of accidents. As a commercial proposition few practical men realized the great though somewhat indirect bearing which the high accident rate in certain branches of the industry had on the efficiency of the workmen. The elimination of these hazardous conditions was approached principally from the humanitarian standpoint. Nevertheless, as shown in Volume IV of this report, great advances in production have resulted directly from the elimination of conditions which were productive of accidents. Similarly, in other directions, improvements which have been introduced simply to relieve the workmen from intolerable conditions of heat or exposure to fumes and smoke have been found to have the most direct bearing on the productive power of the workmen.

CONDITIONS PECULIAR TO LOCALITIES AND TO PARTICULAR COMPANIES.[1]

In addition to the conditions previously discussed, all of which are characteristic of the steel industry as a whole, there are certain features which merit attention in spite of the fact that they have only a limited application. Such, for example, are the infrequency of pay days and the existence of company stores in the Southern district, the ownership of company houses in various localities, and the various bonus, profit-sharing, and pension plans which have been put into effect by certain corporations. On account of the character of these conditions it is impossible to summarize briefly the discussion of them. For the present it is necessary only to call attention to the fact that they are discussed in the last few chapters of this volume.

Finally, attention should be directed to the several appendixes at the end of the volume. These appendixes contain much valuable material, for in the preparation of the report the policy was followed of relegating all complex and extended tables and most of the reprints of documents to the appendixes. In addition to material of that character, however, there is in Appendix F an excellent description of the character and method of work in 1895, prepared by a superintendent of one of the steel mills. This description should be of the greatest interest to students of the historical development of the industry.

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[1] For detailed data and discussion see Chapters XV, XVI, and XVII.

CHAPTER I.

EXTENT AND ORGANIZATION OF THE INDUSTRY.

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EXTENT AND ORGANIZATION OF THE INDUSTRY.

The iron and steel industry for the purposes of the present report may be understood to embrace only the blast furnaces, steel works, and rolling mills, and the auxiliary departments necessary for their operation such as repair shops, yard transportation, and laboratories. In some iron and steel plants the manufacture of the primary rolling mill products is carried through to more highly finished forms, such as nails, spikes, bolts, nuts, cold rolled and drawn products, wire, and woven-wire products; and in a few plants the structural material is fabricated and assembled ready for erection, or large machine shops are maintained for producing machined products of all kinds. None of the departments for the production of such articles was included in the present investigation, as the bulk of such work is done in establishments which are specialized for the products and purposes mentioned. In addition, there are a few plants which have large ore docks, coke ovens, and various by-product departments, as well as coal and iron mines operated in connection with their blast furnaces, but none of these departments was included.

The scope of the investigation, as well as the organization of the industry, will be more clearly understood from the following summary of the departments:

PRODUCING DEPARTMENTS.

Iron smelting:
    Blast-furnace department.
Steel making and iron refining:
    Bessemer converting department.
    Open-hearth department.
    Puddling department.
    Crucible department.
Steel working and fabricating:
    Rolling-mill department—
        a. Blooming and slabbing mills.
        b. Plate mills.
        c. Structural and other shape mills.
        d. Bar, merchant, and guide mills.
        e. Rod mills.
    Forge department.
    Tube-mill department—
        Lap-welding mills.
        Butt-welding mills.
        Seamless mills.
    Foundry department.

General and Repair Departments.

Steam, water, and gas department.
Yard and transportation department.
Electrical department:
  a. Electric light and power.
  b. Electrical inspection and repairs.
Shop department:
  a. Machine shop.
  b. Boiler shop.
  c. Blacksmith shop.
  d. Carpenter, paint, and tin shop.
  e. Car and locomotive repair shop.
  f. Roll shop.
  g. Mason's shop.
  h. Pipe shop, etc.
Mechanical repairs department:
  Machinists, millwrights, and inspectors (except electrical).
Shipping department.
Miscellaneous, including general laboratories.

Such an analysis of the industry serves to indicate its great complexity, even when limited as in the present investigation, and to make clear the difficulty of generalizing in a satisfactory manner any phase of the labor conditions in the industry. This is particularly true in view of the large proportion of the employees who are not directly engaged in steel making or working, but who belong to the so-called "mechanical trades." The conditions of labor of this class of employees are to a large extent determined by the competition of other industries for their services, and, furthermore, their duties are such that their working hours are not directly affected by the fact that the producing departments operate day and night.

CONSOLIDATION OF THE INDUSTRY AND ITS EFFECTS ON THE EMPLOYMENT OF LABOR.

The nature and extent of the rapid consolidation of the iron and steel industry within the past decade is shown in the following tables taken from the Preliminary Report on Iron and Steel for 1909, issued by the Census Bureau, August 25, 1911.[1] The data are shown separately for the blast furnaces and for the steel works and rolling mills.

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[1] It may be noted that the census data for steel works and rolling mills are not quite comparable with those of the present investigation, as they include about 35,000 employees in the sheet and tinplate branch of the industry.

NUMBER OF ESTABLISHMENTS AND EMPLOYEES, AMOUNT OF CAPITAL, AND VALUE OF PRODUCTS OF BLAST FURNACES AND OF STEEL WORKS AND ROLLING MILLS, 1899, 1904, AND 1909.

[Compiled from Preliminary Report on Iron and Steel for 1909, issued by the Census Bureau, August 25, 1911.]

BLAST FURNACES.

Items.	Number or amount.			Per cent of increase.		
	1899	1904	1909	1899 to 1909	1899 to 1904	1904 to 1909
Number of establishments	224	191	208	[1] 7.1	[1] 14.7	8.9
Number of employees	41,121	37,414	43,013	4.6	[1] 9.0	15.0
Salaried employees	1,763	2,236	4,584	160.0	26.8	105.0
Wage earners (average number)	39,358	35,178	38,429	[1] 2.4	[1] 10.6	9.2
Capital	$143,329,000	$236,401,000	$487,581,000	240.2	64.9	106.3
Value of products	$206,823,000	$231,889,000	$391,429,000	89.3	12.1	68.8

STEEL WORKS AND ROLLING MILLS.

Number of establishments	445	415	446	0.2	[1] 6.7	7.5
Number of employees	190,703	221,892	260,123	36.4	16.4	17.2
Salaried employees	7,454	14,330	20,639	176.9	92.2	44.0
Wage earners (average number)	183,249	207,562	239,484	30.7	13.3	15.4
Capital	$430,232,000	$700,182,000	$1,004,735,000	133.5	62.7	43.5
Value of products	$597,212,000	$673,965,000	$985,723,000	65.1	12.9	46.3

[1] Decrease.

A number of striking facts of the greatest significance in connection with the labor situation in the industry are revealed by these tables.

First. The remarkable expansion of the industry in recent years has not brought with it commensurate increases in the opportunities for employment, for the increase in the number of employees during the past decade has been very much less than the increase of capital or of the value of the products. This is particularly true of the blast furnaces. In this branch of the industry during the decade 1899 to 1909 the number of wage earners slightly decreased, while the capitalization tripled and the value of the products very nearly doubled. In 1899 the value of the products of the blast furnaces per wage earner was $5,255; by 1909 it had increased to $10,186 per wage earner. In the steel works and rolling mills very much the same situation, though in a less marked degree, is found. In this branch the number of wage earners increased during this period only 30.7 per cent, while the capital more than doubled, and the value of the products increased 65.1 per cent. The value of the products of steel works and rolling mills per wage earner increased from $3,259 in 1899 to $4,116 in 1909.

The very slight increase in the labor force in the past decade is the direct result of the great increase in the amount of capital. During the past 10 years the displacement of workmen by new mechanical methods, requiring the expenditure of vast amounts of capital, has been one of the most important features of the industry. This development has taken place most strikingly in the larger establishments. In one of the largest steel plants in the country, considering only the departments operated in both 1900 and 1910, the number of employees actually decreased from 2,832 in 1900 to 2,682 in 1910, or 5 per cent, while the average daily production increased 50 per cent. So far as direct opportunity for employment is concerned, therefore, the growth and expansion of the iron and steel industry during the last decade has been of little significance to workmen. From 1899 to 1909 the workman's opportunities for employment in the combined blast furnace, steel works, and rolling mills increased only 25 per cent, while the opportunities for the investment of capital increased 160 per cent.

Second. Along with the increase of the amount of capital has gone the aggregation of the business into larger and larger units. This movement has been in two directions: First, increase in the size of plants; and, second, consolidation of the industry in the hands of large corporations.

It will be seen from the figures presented above that in the case of blast furnaces the average amount of capital invested per establishment has increased from approximately $640,000 in 1899 to $1,230,000 in 1904, and to $2,340,000 in 1909, an increase of over 265 per cent in the period 1899 to 1909. This is due not only to an increase of 240.2 per cent in the total amount of capital invested in blast furnaces, but to an actual decrease of 7.1 per cent in the number of establishments.

Similarly in the case of steel works and rolling mills the average amount of capital invested per establishment has increased from approximately $970,000 in 1899 to $1,690,000 in 1904 and to $2,250,000 in 1909, an increase of 132 per cent in the period 1899 to 1909.[1]

This increase in capitalization largely represents real investment and not simply nominal capitalization of earning power. It will be noted that the increase during the era of consolidation represented by the period from 1899 to 1904 is very little greater than during the latter part of the decade during which there have been no important new consolidations or organizations of new companies. The report of the Bureau of Corporations on the Steel Industry, published in 1911, has shown that the physical plants of the steel companies (that is, the blast furnaces, steel works, and rolling mills) have been capitalized at very nearly the tangible value of the property.

Along with this increase in the size of the plants has gone the well-known consolidation of the industry of which the chief feature was the organization of the United States Steel Corporation in 1901.

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[1] The Abstract of Statistics of Manufactures of the United States (Bulletin of the Bureau of the Census), 1910, p. 27, shows that of the blast furnace plants 41.3 per cent produced pig iron to the value of $1,000,000 and over in 1909, as compared with 25.8 per cent in 1904. Similarly, 41.7 per cent of the steel works and rolling mills in 1909 produced goods valued at $1,000,000 and over, as compared with 31.6 per cent in 1904.

This corporation to-day controls approximately one-half of the total production of the industry, although the proportion varies widely in the various branches. A very large part of the remainder of the production is in the hands of a small number of large consolidations, chief among which may be mentioned the Republic Iron and Steel Co., the Cambria Steel Co., The Pennsylvania Steel Co., the Jones & Laughlin Steel Co., the Bethlehem Steel Corporation, the Lackawanna Steel Co., the Reading Iron Co., the Youngstown Sheet and Tube Co., and the Colorado Fuel and Iron Co. These companies together produce about one-fourth of the total output of the industry. Nearly three-fourths of the entire industry, therefore, is in the control of large organizations of capital. This factor of consolidation is of the greatest significance in determining the conditions of labor in the industry.[1]

INCREASES IN PRODUCTION AND CHANGES IN CHARACTER OF PRODUCTS.

The detailed statistics which have been collected year by year by the American Iron and Steel Association' make it possible to trace the growth and the gradual, but complete, transformation in the character of the products in a way that is possible in few industries.

As regards growth, every decade, except one, since 1860 has seen the average annual production of pig iron practically doubled. The blast furnaces of the United States in 1910 produced more than 25 times as much pig iron as the average annual production from 1860 to 1869, and the steel works produced 1,600 times as much steel. For convenience, the increase in the production of iron and steel decade by decade is shown in the table which follows. It should be remembered, of course, that all steel products are derived originally from pig iron, except for a very small quantity produced directly from the ore.

INCREASE IN PRODUCTION OF PIG IRON AND STEEL, BY DECADES, 1860 TO 1909.

[Compiled from Annual Statistical Reports of American Iron and Steel Association.]

Decades.	Average annual production during each decade (tons of 2,240 pounds).		Per cent of increase over preceding decade.	
	Pig iron.	Steel.	Pig iron.	Steel.
1860 to 1869	1,052,301	16,303	....	....
1870 to 1879	2,188,706	386,243	108	2,269
1880 to 1889	5,153,953	2,169,542	136	462
1890 to 1899	9,353,822	5,966,711	82	175
1900 to 1909	19,780,761	17,176.698	112	188

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[1] The Abstract of Statistics of Manufactures of the United States (Bulletin of the Bureau of the Census), 1910, p. 24, shows that, in 1909, in terms of value, 98.7 per cent of the blast furnace products and 99.5 per cent of the steel works and rolling mills products were produced in establishments owned by corporations.

It will be seen from this table that in every decade, except 1890 to 1899, the annual production of pig iron was more than double that of the preceding decade, while in 1890 to 1899 the rate of increase was but little less. The rate of increase in the production of steel has been even more phenomenal and has likewise been a steady growth determined by the general industrial demands of the country and the improvement of the methods of production. Prior to 1870 the quantity of steel produced in the United States was an almost negligible fraction of the total pig iron production. Beginning with 1870, however, this branch of the industry has grown so rapidly that in 1910 the production of steel was only 5 per cent less than the enormous pig iron production of 27,000,000 tons. This phenomenal growth has been due to the invention and development of the Bessemer and open-hearth methods of producing steel cheaply and in large units. The effect of the introduction of these new methods on the character of the industry is brought out in the following table, which shows in detail the average annual output of the principal products of the industry in each five years from 1860 to 1899 and the annual output year by year since 1900.

TONS OF IRON AND STEEL PRODUCED, 1860 TO 1910, BY KIND OF PRODUCT.

[Compiled from Annual Statistical Reports of American Iron and Steel Association. The numbers given are tons of 2,240 pounds.]

Years.	Pig iron.	Steel.				
		Bessemer.	Open-hearth.	Crucible.	Miscellaneous.	Total steel production.
1860 to 1864 [1]	807,603	....	....	(2)	(2)	[8] 9,724
1865 to 1869 [1]	1,296,998	[4] 6,994	[5] 893	[6] 17,506	(7)	[8] 21,881
1870 to 1874 [1]	2,176,989	101,731	3,036	[6] 35,747	(7)	140,514
1875 to 1879 [1]	2,200,471	557,732	26,426	39,089	8,724	631,971
1880 to 1884 [1]	4,259,229	1,363,214	122,453	69,177	4,506	1,559,350
1885 to 1889 [1]	6,047,677	2,433,204	272,656	70,218	3,655	2,779,733
1890 to 1894 [1]	8,084,293	3,578,344	657,140	68,757	3,942	4,308.183
1895 to 1899 [1]	10,623,350	5,699,944	1,844,432	77,855	3,008	7,625,239
1900	13,789,242	6,684,770	3,398.135	100,562	4,862	10,188,329
1901	15,878,354	8,713,302	4,656.309	98.513	5,471	13,473,595
1902	17,821,307	9,138,363	5,687,729	112,772	8,386	14,947,250
1903	18,009,252	8,592,829	5,829,911	102,434	9,804	14,534,978
1904	16,497,033	7.859,140	5,908,166	83,391	9,190	13,859,887
1905	22,992,380	10,941,375	8,971,376	102,233	8,963	20,023,947
1906	25,307.191	12,275,830	10,980,413	127.513	14,380	23,398,136
1907	25,781,361	11,667,549	11.549,736	131,234	14,075	23,362,594
1908	15,936,018	6,116,755	7,836,729	63,631	6,132	14,023,247
1909	25,795,471	9,330,783	14,493,936	107,355	22,947	23,955.021
1910	27,303,565	9,412,772	16,504,509	122,308	55,335	26,094,919

[1] Average annual production.
[2] Not reported.
[3] Average for 3 years, 1860, 1863, and 1864. No reports for 1861 and 1862.
[4] Average for 3 years, 1867 to 1869 only; Bessemer steel was first produced commercially in this country in 1867.
[5] Year 1869 only; open-hearth steel was first produced commercially in this country late in 1868.
[6] Includes miscellaneous steel.
[7] Included under crucible steel.
[8] Average annual production for 5 years.

TONS OF IRON AND STEEL PRODUCED, 1860 TO 1910, BY KIND OF PRODUCT—Conc'd.

Years.	Finished rolled iron (puddled iron).	Finished rolled products of iron and steel.					
		Iron and steel rails.	Plates and sheets, except nail plate.	Wire rods.	Structural shapes, not including plates.	Bars, hoops, nail plate, and all other forms.	Total.
1860 to 1864 [1]	(2)	....	....	....	....	....	....
1865 to 1869 [1]	936,778	419,550	....	....	....	....	....
1870 to 1874 [1]	1,449,724	717,004	....	....	....	....	....
1875 to 1879 [1]	1,462,251	791,573	....	....	....	....	....
1880 to 1884 [1]	2,102,965	1,339,335	....	....	....	....	....
1885 to 1889 [1]	1,622,533	1,528,612	[3] 643,226	[4] 321,810	(5)	[6] 3,161,768	[3] 5,029,994
1890 to 1894 [1]	(7)	1,380,511	719,523	566,442	(5)	[8] 2,773,034	5,439,510
1895 to 1899 [1]	(7)	1,665,996	1,303,265	898,787	629,971	3,004,968	7,502,987
1900	(7)	2,385,682	1,794,528	846,291	815,161	3,645,781	9,487,443
1901	(7)	2,874,639	2,254,425	1,365,934	1,013,150	4,841,179	12,349,327
1902	(7)	2,947,933	2,665,409	1,574.293	1,300,326	5,456,155	13,944,116
1903	(7)	2,992,477	2,599,665	1,503,455	1,095,813	5,016,287	13,207,697
1904	1,760,084	2,284,711	2,421,398	1,699,028	949,146	4,659,098	12,013,381
1905	2,059,990	3,375,929	3,532,230	1,808,688	1,660,519	6,462,649	16,840,015
1906	2,186,557	3,977,887	4,182,156	1,871,614	2,118,772	7,438,039	19,588,468
1907	2,200,086	3,633,654	4,248,832	2,017,583	1,940,352	8,024,401	19,864,822
1908	1,238,449	1,921,015	2,649,693	1,816,949	1,083,181	4,357,355	11,828,193
1909	1,709,431	3,023,845	4,234,346	2,335,685	2,275,562	7,775,252	19,644,690
1910	1,740,156	3,636,031	4,955,484	2,241,830	2,266,890	8,521,044	21,621,279

[1] Average annual production.
[2] Not reported.
[3] Average for 3 years only.
[4] Average for 2 years only.
[5] Included with bars, hoops, etc.
[6] Including structural shapes; average for 3 years only.
[7] Not reported separately.
[8] Including structural shapes.

From 1860 to 1864, although the pig-iron production averaged 807,603 tons per year, the average steel production was only 9,724 tons. The greater part of the remainder of the pig iron was utilized in castings and in the manufacture of wrought iron. The crucible process of steel making had only a few years before been successfully introduced into the United States, and the greater part of the steel was made by the extremely slow and costly "cementation process." Before 1865, however, two inventions had been made that revolutionized this and all other modern industries. In 1856 Sir Henry Bessemer, in England, and William Kelly, in the United States, almost simultaneously worked out the method of making steel by the simple and cheap method of burning out its carbon and silicon by blowing air through a bath of molten iron. The first Bessemer steel produced in an American steel plant was made experimentally in 1864, but none was produced on a commercial scale until 1867.[1] In 1864 Sir William Siemens and the Martin brothers introduced in France the open-hearth process, utilizing the previous invention of the Siemens regenerative furnace for the maintenance of high temperatures. Before the end of the next five years—1865 to 1869—steel had been produced commercially in the United States by both these processes, and the new era of steel had begun. The crucible process also was much more widely used during this time. Nevertheless, 72 per cent of the entire pig-iron production was puddled and rolled into finished wrought iron. The puddling process required a very large amount of fuel and highly skilled labor, and there was consequently great reason for every effort to be made to introduce the more economical Bessemer process. However, in addition to great practical difficulties connected with the process, there was much prejudice against the new steel products, so that the production of Bessemer steel from 1870 to 1874 remained less than one-fourteenth as great as the annual output of puddled iron. From 1875 to 1879 Bessemer steel became firmly established, and its average annual production was more than five times as great as during the preceding five years. In 1877 a discovery was made which entirely changed the status of the open-hearth process. Up to this time the Bessemer process had possessed a tremendous advantage, in that practically the same grade of steel could be produced as in the open-hearth furnace and at a very much lower cost. Both processes had one very great disadvantage, however, in that only selected iron containing very little phosphorus could be utilized. In 1877 Sidney Gilchrist Thomas patented in England a method by which phosphorus in considerable quantities could be eliminated by the use of a slag very rich in lime. These patent rights in United States territory were purchased in 1879 by the Bessemer Steel Company Limited.[1] In Europe this idea was applied to the Bessemer converter, and is still used to a great extent (Thomas basic converter process), but in the United States it was found more desirable to apply the same idea to the open-hearth process. The development of the basic open-hearth process has, however, been very slow until recent years, because of the abundance of low-phosphorus iron available and the relatively high cost of operation.

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[1] History of the Manufacture of Iron in All Ages, by James M. Swank, Philadelphia, 2d. Ed., 1892, pp. 409, 413, and 415.

During the years 1880 to 1884 the production of puddled iron reached practically its highest point and has slightly declined since that time. During the five years 1885 to 1889 the production of Bessemer steel for the first time exceeded that of puddled iron, the average annual production of Bessemer steel during the five years being 2,433,204 tons and of puddled iron 1,622,533 tons. The production of Bessemer steel continued to increase rapidly until 1906, when it reached the maximum production of 12,275,830 tons. For a number of years, especially since 1900, the open-hearth process had been growing rapidly, due both to the greater difficulty of securing good low-phosphorus (Bessemer) iron and to a demand for better steel which could be made to conform more exactly and uniformly to specifications. By introducing various labor-saving devices and increasing the size of the furnaces it has been possible gradually to reduce the disparity in the cost of production by the two methods until the open-hearth process exceeds the Bessemer process in the amount of its products, and is even further beyond it in the value of the production. During the past five years the electric furnace has passed the experimental stage and is likely soon to become a factor of great significance. The increase in the amount of miscellaneous steel within the last three years, shown in the table, is due to the introduction of this method of production.

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[1] History of the Manufacture of Iron in All Ages, by James M. Swank, Philadelphia, 2d. Ed., 1892, pp. 405 and 406.

These changes in the fundamental methods of production have not been outlined simply for historical reasons, but because of their influence on the condition of labor in the industry. Although the effects of these changes will be fully developed at a later point it is well to note the most fundamental of them here. In every case the change in processes has carried with it the elimination of much heavy manual labor done under conditions of exhausting heat, and at the same time the decrease in the proportion of skilled men and their replacement either by unskilled workmen or by semiskilled machine operators of various kinds. This may be briefly explained as follows: In the crucible process the workmen, most of whom are highly skilled, do very heavy work for a short time under the most extreme conditions of heat to which human beings are ever exposed in any industry. Similarly the puddler, whose work has been in large measure displaced by the cheaper methods of steel production, is a highly skilled workman. His work is exceedingly strenuous and is performed while he is exposed to very high temperatures. Altogether, the work of the puddler is probably the hardest and most exhausting of any occupation in this industry.

The Bessemer process, which supplanted the puddling mill to a large degree, requires a much smaller proportion of highly skilled men, and only a few of the employees work under conditions of extreme heat or perform very heavy manual labor. With the open-hearth furnace, which is rapidly displacing the Bessemer converter as the leading method of producing steel, very few highly skilled men are required and the amount of severe and exhausting labor is still further reduced.

Similarly, among the finished rolled products the most important developments have been in the production of plates and structural shapes, which are rolled in mechanical mills in which the proportion of skilled men is smaller and the amount of exhausting manual labor is less than in the mills in which the work is largely done by hand. If it were possible to separate the products of the mechanical mills definitely from the products of the hand mills the change which has taken place would be even more striking.

The following table shows in considerable detail the relative importance of the principal products in 1910, and also suggests the degree to which steel has superseded iron in modern use:

PRODUCTION OF SPECIFIED ARTICLES OF ROLLED IRON AND STEEL IN 1910.

[From the Annual Statistical Report of the American Iron and Steel Association for 1910, p. 87.]

Articles.	Iron (gross tons).	Steel (gross tons).	Total (gross tons).
Rails	230	3,635,801	3,636,031
Structural shapes	426	2,266,464	2,266,890
Plates, No. 12 and thicker	37,763	2,769,965	2,807,728
Sheets, No. 13 and thinner	53,355	2,094,401	2,147,756
Nail and spike plate	11,366	33,928	45,294
Wire rods	627	2,241,203	2,241,830
Rolled forging blooms and forging billets	202	459,731	459,933
Merchant bars	1,074,163	2,711,568	3,785,731
Bars for reenforced concrete work	4,645	236,464	241,109
Skelp, flue, etc	350,578	1,477,616	1,828,194
Splice bars	14,352	208,670	223,022
Hoops	....	262,214	262,214
Bands and cotton ties	....	424,979	424,979
Sheet piling	....	26,598	26,598
Railroad ties	....	49,048	49,048
All other finished rolled products	192,449	982,473	1,174,922
Total	1,740,156	19,881,123	21,621,279

It will be seen from the above table that while nearly all the finished iron is made into light products, such as sheets, merchant bars, and skelp, nearly 45 per cent of the finished steel is being made into heavy products, such as rails, structural shapes, and plates.

PRESENT GEOGRAPHICAL DISTRIBUTION OF THE INDUSTRY.

The iron and steel industry, like most of the other large industries, is to a very great degree concentrated around a comparatively small number of large producing centers. By far the most important of these is Pittsburgh, in the immediate neighborhood of which are located not only a very large proportion of the blast furnaces of the country, but also an even greater proportion of the steel works and rolling mills. Allegheny County alone in 1910 produced 19 per cent of the pig iron and 27 per cent of the steel of the entire country. The predominance of Pittsburgh in the industry, however, is not so great at the present time as formerly. In addition to Pittsburgh, the following towns and cities comprise the important centers of the industry at the present day: Allentown, Reading, Harrisburg, Johnstown, and Philadelphia, Pa.; Youngstown, Cleveland, and Ironton, Ohio; Baltimore, Md.; Wheeling, W. Va.; Buffalo, N. Y.; Chicago, Ill.; Birmingham, Ala.; St. Louis, Mo.; and Pueblo, Colo. In considering these centers it is necessary to understand that they include also all the works in their general vicinity. For example, in the case of Chicago, all the plants along Lake Michigan and as far south as Joliet are to be understood as being embraced in that general district. Similarly, the Birmingham district includes the plants that are in Gadsden and Ensley, Ala.

In the centers which have been enumerated above are located the plants which produce perhaps more than three-fourths of the entire tonnage of the United States. However, it must be understood that there are isolated blast furnaces scattered over the eastern part of the United States, and furthermore, almost every important city has a rolling mill and a small steel plant of some local significance. The localization of the industry in such a comparatively small number of producing centers is of very great significance in connection with the general conditions of labor. In the first place, the manufactures in these so-called steel towns are generally so limited to the production of iron and steel that any depression in the iron and steel industry means an almost complete cessation of work with its consequent hardship for the majority of the members of the community. A second effect of this specialization of the producing centers has been that the iron and steel industry has been affected to a much less degree by the progress of labor conditions in other industries than it would have been had it come into more direct competition for labor with such industries. Finally, the rapid expansion of the industry in a comparatively small number of centers tended to increase the population much more rapidly than the building and sanitary improvements of the towns were capable of properly accommodating. The result has been in many cases a high degree of congestion and the creation of housing conditions which have been the subject of much criticism during recent years.

As widely distributed as the iron and steel industry is throughout the country[1] from the standpoint of labor conditions it may be divided into a small number of districts of very unequal size, but of nearly uniform conditions in each district as regards wages, character of the workmen, and general conditions of employment. There are, of course, inexplicable differences in wages, hours of labor, and other conditions of labor in establishments located in the same city, but except for these entirely phenomenal cases the general situation in a given district is remarkably uniform. Therefore the districts used in the present report were determined on the basis of wages and general conditions of labor, and not along geographical lines. Indeed, the attempt to follow ordinary geographical divisions in this as in other industries is almost sure to result in confusion. The following outline will serve to indicate the limits of the six industrial districts used in the present report:

The New England district embraces New England and the eastern part of New York.

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[1] The distribution, by States, of the production of all the principal iron and steel products is shown in detail in a series of tables, which are included in Appendix A of this volume. These tables are valuable for reference purposes in connection with several of the chapters, in which knowledge of the geographical distribution of the industry is desirable.

The Eastern district consists essentially of New Jersey, Maryland, and the eastern and central parts of Pennsylvania.

The Pittsburgh district, so called, contains not only the plants in the immediate vicinity of Pittsburgh, but all those in western Pennsylvania, in eastern Ohio, and in the northern part of West Virginia.

The Great Lakes and Middle West district contains the plants along the Great Lakes and those in the north central States, with the exception of the southern and eastern section of Ohio, together with the scattered plants lying as far west as Colorado.

The Southern district includes the southern section of Ohio and all of the Southern States except Maryland.

The Pacific Coast district includes the few plants along the coast.

Generally speaking, each of these districts is characterized by fairly uniform labor conditions which differ in a greater or less degree from those of the other districts. For example, the Eastern district is characterized by lower wages, particularly for the unskilled employees, than the Pittsburgh and Great Lakes and Middle West districts. Furthermore, in this district a great many of the plants have been under the same ownership for a long time, and traditional methods of work and of dealing with employees still persist in these establishments. The Great Lakes and Middle West district does not differ in any material respect from the Pittsburgh district, except that, covering as it does a far greater area, there are much wider variations in the rates of wages and in working conditions generally. All conditions of labor in the Southern district, which it will be noted includes the southern part of Ohio, are influenced and to a very large extent determined by the presence of Negro labor and by the comparative lack of industrial development in the South until quite recently. The wages in the South, for example, are very much lower than in either of the other districts, and there exist to a large degree such institutions as company stores and the scrip system of payment, which were made the subject of legislation in most of the northern and western States many years ago.

CHAPTER II.

THE MODERN STEEL WORKS.

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INTRODUCTION.

A striking feature of the steel industry of the present day is the degree to which all the processes of steel making have been brought together into single large plants. Twenty-five years ago it was the exception rather than the rule to find a plant containing blast furnaces, as well as steel works and rolling mills. To-day the situation is entirely changed and few new blast furnaces are being constructed which are not connected with some steel-producing plant. There are, of course, many blast furnaces existing to-day which are in no way connected with steel plants, but nearly all of such furnaces were established more than a quarter of a century ago and are maintained chiefly because the investment of capital is so large that their abandonment would mean a great loss. Similarly there are a number of rolling mills which are in no way connected with steel works or blast furnaces, but as a general rule either they are of small size and devoted to the manufacture of some specialized product, or they were established when the importance of having all the producing units of the industry as closely connected as possible was not realized to the same extent as at present. The typical steel plant of the present day, therefore, is an institution of great size and complexity, covering many acres of ground, embracing all the phases of steel manufacture, and frequently having large shops in which the finished material is still further fabricated or more highly finished.

The essential characteristic of the modern steel works is the assembling within a single plant of all the processes of manufacture from the reduction of the ore to the manufacture of the finished product. The blast furnaces, it is true, may be operated as a separate plant, nevertheless, the separation is only nominal and for administrative convenience. Such plants may employ only twelve or fifteen hundred men, but the characteristic conditions are in no wise different from those of plants employing five or six thousand workmen. The number of men employed depends entirely on the amount and nature of the product.

All that is apparent from an exterior view of such a plant is a number of large buildings, overhung with a pall of reddish-tinted smoke and steam, above which the huge stacks of the blast furnaces and the heating stoves tower, with a glimpse here and there of huge piles of ore in the neighborhood of the furnaces. Around the whole is a high board fence to keep outsiders from wandering into danger unawares or from interfering with the workers inside the plant. From time to time the smoke is lighted up by a shower of sparks as the Bessemer converter is blown or the blast furnace is tapped. Momentarily also huge whirling rings of steam are thrown up several hundred feet into the air as the great engines which drive the blooming and plate mills are reversed. Except for the puffing of the locomotives, the whistle signals which sound sharply in all directions, and the heavy murmur of confused sounds, there is little to indicate to an outsider the activity within.

The first conception of the system and completeness of organization is gained when the visitor seeks entrance to the works, for no one can enter such a plant without the fact being recorded. The workman must make his record by punching the time clock, or by hanging up or removing his time check, and the visitor must have his pass. Such passes are easily secured at most of the works if the name, business, and reason for visiting the works are properly made known, and a guide is always furnished for the protection both of the company and the visitor. The pass is punched at the gate and after a walk through the yards, across many narrow-gauge and standard-gauge tracks, along which run numerous trains loaded with ladles of hot metal, or cars of material and products, the blast furnaces are reached. The nearer the approach the more fully is the immense scale of construction and operation appreciated. The mountains of ore and the blast furnaces and stoves, which were almost unnoticed from the outside, now loom up in their real proportions.

BLAST FURNACES AND DOCKS.

If the plant is on the Great Lakes, the visitor is led first to the docks to see the ore unloaded. Alongside the docks immense vessels are drawn up and the hatches removed, leaving all parts of the hold easily reached. Overhead are the unloading machines, which are of two main types, the Brown " fast " plants and the Hulett unloaders. The " fast " plants are bridgelike structures of steel-frame construction, one end of which reaches out over the vessel, while the other reaches over a number of tracks to the ore piles. Suspended by trolley from this bridge swings the ore bucket by which the ore is removed from the vessel, swung along the bridge, and dumped automatically either into the cars beneath or on the ore piles beyond. The Hulett unloader is a smaller and more compact machine, consisting essentially of a short bridge carrying a huge walking beam, at one end of which is mounted a huge steel leg carrying a "clam-shell" bucket of about 5 tons' capacity. As the walking beam rocks downward this leg is thrust into the hold and the jaws of the bucket come together with a crunching sound as they take in their five tons of ore. The walking beam rocks upward and then moves on its carriage back along the bridge until the bucket is directly over a car, when the jaws are opened once more and the ore falls out. Only by such methods could the great quantities of ore transported on the Lakes be handled. All the handling at the ports must be done during the "open season," from May to November, and the problem of handling and stocking the ore supply for the whole year is one of tremendous magnitude.

If the visitor should happen to be at one of the interior plants, as in the neighborhood of Pittsburgh, he would be shown the unloading of the cars of ore, either by running the cars on high trestles and then, by opening up the hoppers, allowing the ore to run down onto the piles below, or by means of the "car-dumper," a huge machine which picks up a car at a time and dumps the ore onto the ore pile or into bins. The other materials, limestone and coke, are handled in much the same way.

The essential thing in handling materials for the blast furnaces is to have such arrangements that the materials can be fed into the furnaces uninterruptedly. This would not be possible if they were simply allowed to remain in piles in the yards, so a great supply ready for immediate use is constantly kept in the stockhouses. The ore is removed from the piles to the stockhouses usually by ore bridges with the help of transfer cars. The "ore bridges" are simply huge bridgelike cranes. With their span of several hundred feet they tower high above the surrounding machinery. The huge buckets swing down to the pile, scrape up a full load and are away on their travel across the bridge to the waiting cars before the eye can fully grasp the purpose of the structures. Back and forth along the bridge the bucket passes, carrying each time a load of several tons. The electrically-driven transfer cars carry their loads up an inclined trestle to the level above the stock bins, and there the hopper bottom is opened, the material is dumped into the bins, and the cars return for another load.

At the bottom of the bins are chutes by which the ore, limestone, and coke are run out into the so-called "larries," small electrically driven, hopper-bottomed cars, which in unending succession carry the materials from the bins to furnaces.

The great stacks of the blast furnaces, a hundred feet in height, flanked on either side by the equally large heating stoves, loom up like towers as they are approached. On closer observation a double inclined track will be seen reaching from the ground to the top of each furnace, where it seems to bear some connection with the complicated machinery of the furnace top. This inclined track is the "skip-hoist," and the small cars which run up and down it every few moments are the "skips," which carry the materials, brought by the larries, to the furnace top and there automatically dump them into a huge hopper. Through this hopper the materials pass into the furnace, where they are smelted to reappear as slag and molten iron. Up to this time, except for the men on the larries and transfer cars, few workmen have been seen. The buckets of the unloading machines, as well as the ore bridges, the car dumpers, and the skips move with wonderful precision, guided by unseen hands.

On the casting floor of the furnace the workman first comes into notice. If it happens to be before a cast, some half dozen men may be busy in preparing the "runners" or troughs in which the metal is led from the tap hole of the furnace into the ladles, but as practically all their work is finished within the first hour after a cast, and the casts are from four to six hours apart, it is more likely that most of the men will be seen seated on benches or in the "bunk house." In many cases the runners are simply troughs made up in the sand floor around the furnace, while in others they are built of iron castings, which must be carefully lined with clay and thoroughly dried for every cast. At one side of the furnace, from 45° to 90° from the tap hole, is a second opening through the furnace wall, the "cinder notch," through which the slag or cinder is drawn off from time to time. On one side of the casting floor, or sometimes beneath the floor, which is usually from 15 to 20 feet above the ground, are the tracks for the iron ladles, and on the other, on the same side as the cinder notch, are the tracks for the cinder ladles.

As the time for the cast approaches the activity of the men increases, the tools for drilling out the tap hole are brought up, and boards are laid across the runner for the men to sit or stand on while drilling. The drilling is done either by hand with a heavy bar swung by four men, which takes 10 to 25 minutes, or the first part of the clay is removed with a pneumatic drill and the last part by hand. The pneumatic drill is much quicker, but it works so rapidly as to make it dangerous. When the clay of the tap hole is pierced, the molten iron under the heavy air pressure, which in the modern furnace is reduced, but not cut off during the tap, rushes out with a great burst of flame and a shower of sparks and quickly fills up the trough in front of the furnace and issues into the runner which leads to the iron ladles. As the trough fills still more the level of the molten metal is raised so that the floating slag which is now beginning to come from the furnace is brought against a clay-faced iron plate or "skimmer" and diverted into a side runner which leads to the slag ladles. When the first iron ladle is filled, a second side runner is opened and the first one shut off, and this is continued until the entire row of iron ladles are filled. They are then coupled up to a locomotive and hauled either to the Bessemer or open-hearth department or to the "pig-casting machine." The slag continues to pour out of the tap hole for several minutes after the iron has ceased to flow, but finally the furnace is drained and the keeper and one or two of his helpers set about closing up the tap hole with the "mud gun."

This mud gun is simply a long cylinder with a steam piston inside. On the top side of the cylinder is a hopper-shaped opening through which balls of wet clay can be introduced into the cylinder. The keeper pulls a lever and the piston is thrown forward, driving the balls of clay out of the mouth of the gun and into the tap hole with great force. The piston is then drawn back behind the hopper, and other clay balls are thrown in by the clay man, and this is repeated until the tap hole is closed with a solid mass of rapidly hardening clay. All of the work during the cast is extremely hot and exhausting. In the meantime the rest of the keeper's helpers and the cinder snappers have started to clean up the floor. The iron and slag which has been left in the runners must be loosened up with bars and broken up into pieces small enough to allow them to be dragged away by a small overhead electric crane, which is a part of the equipment of the modern furnace and which has removed some of the hardest work of the casting crew. The work must be done quickly before the iron has thoroughly cooled and hardened. At the end of half an hour the floor is entirely cleaned and the men set about making up the runners for the next cast. These casts in the modern furnace are usually four hours apart, which leaves the men nearly an hour and a half during which they can rest and recuperate before the next cast. In the modern works the men, as a rule, are not allowed to leave the plant during this time, but a more or less comfortable "bunk house," frequently a corrugated-iron structure with benches inside, is usually provided, in which they are protected from the weather.

Leaving the furnace and following the metal tracks the visitor is led either to the pig-casting machine or to the Bessemer or open-hearth department. The pig-casting machine has developed out of the necessity for taking care of the surplus production of the blast furnaces, which can not be used directly by either the Bessemer converters or the open-hearth furnaces, or of the entire production when those departments are shut down, as is usually the case from Saturday night till Sunday afternoon. As the pig-casting machine is an important element in connection with the cessation of operations in the steel works on Sunday, it is well to give it some attention. The machine consists essentially of an endless chain of shallow, specially shaped molds. This chain is about 100 feet long and passes over gears at each end, by means of which it is driven. At the lower end of the chain of molds is a track upon which the ladle cars of molten iron, direct from the blast furnace, are brought into position. A chain from a small overhead crane is hooked onto the ladle and it is tilted slowly forward on its trunnions until the hot metal begins to pour out. The stream of metal falls into a runner which guides it into the molds, which pass in endless succession under the runner. The speed of the chain of molds and the volume of the stream of metal are so nicely adjusted that each mold receives just the proper amount of metal and almost none is lost. A man stands by the runner all the time and with a bar keeps the metal running freely. This is a hot and dangerous position. By the time the molds reach the upper end of their course the pigs have cooled sufficiently to solidify, and in cooling have contracted sufficiently to cause them ordinarily to drop out of the molds into the cars below as they pass over the gears at the turn. Sometimes they do not fall and it is necessary for men with heavy sledges or bars to force them out of the molds. The "pig-casting machine" provides an efficient and relatively economical method of disposing of the metal, and if it had not been invented the problem of shutting down the steel works and rolling mills on Sundays would have been much more difficult than it is.

There is another method of disposing of the "Sunday metal," which is evident as soon as one reaches the Bessemer or open-hearth department. Among the most conspicuous features of these buildings are the huge reservoirs into which the ladles of molten metal from the blast furnaces are poured. These reservoirs or "mixers," as they are known, were originally devised for the double purpose of mixing the metal coming from different blast furnaces and thus obtaining a more uniform quality, and of holding the metal at a uniform temperature until it was needed. They serve both purposes admirably and, with little additional heat, a bath of metal can be kept at a uniform temperature throughout the Sunday shutdown. The mixers are of various shapes and sizes, but the most common forms are hemispherical or semicylindrical, with a large spout on one side, which gives it the appearance of an enormous teapot. The mixers are made of very heavy steel plates and are thickly lined with fire brick and clay. They are mounted on great trunnions, so that they can be tilted back and forth to pour out the metal as it is needed. The largest yet designed is to hold 1,000 tons, but the most common capacity is from 250 to 400 tons. As the modern blast furnace will produce about 400 tons per day, and the large plants regularly have from 3 to 11 furnaces, the difficulty of caring for all the hot metal in mixers and the necessity for the pig-casting machine under present conditions is apparent.

BESSEMER DEPARTMENT.

The Bessemer department is the most spectacular and interesting part of the steel works. Day and night the place is conspicuous from the glare of the great flame rushing from the mouth of the converters, which flares into intense brightness for several minutes and then dies down as the last of the carbon and silicon are burnt out of the bath of iron. The Bessemer building is scarcely more than a roof, with walls extending from the top down low enough to protect the workmen from the weather. Everywhere it is as open as possible to allow the smoke and heat to escape. The work is done on three distinct levels. The main level, which is the highest of the three, is that on which the molten iron is carried and poured into the mouth of the converters. On this level are the mixer, the cupolas (essentially miniature blast furnaces in which pig iron is melted), and the converters. The converter vessels, of which there are two, three, or four, are huge egg-shaped affairs made of steel plates and thickly lined with a very refractory material. They are mounted on large trunnions, so that they can be tilted, and are controlled by hydraulic power. On practically the same level as the converters, but on the other side of the building, is the blowers' platform, or "pulpit," from which is usually controlled all the machinery for moving the converters and the steel ladles. This is the best place from which to watch the process, for it must be in such a position that from it the blower can see and direct all the operations. Below the blowers' platform is the "steel pourers' platform," which constitutes the second level. The third level is the ground, on which are the tracks on which the "mold cars" run, and which also constitutes the pit in which the slag and refuse metal are temporarily disposed of.

The process starts when a ladle containing about 10 tons of hot metal is brought down on a small cable-drawn car from the cupolas or the mixer. When the car stops at the proper point, the converter is tilted forward so that its mouth is just under the ladle. One of the workmen runs out into the heat and hooks onto the ladle a chain by which it is tilted so that the molten metal runs out into the converter. Through a large number of holes in the bottom of the converter air under a pressure of 15 to 20 pounds is blown as soon as the metal has been placed in the converter. As soon as this air strikes the bath of metal, now lying in the belly of the converter, the surface impurities are burned, and great volumes of smoke, lighted by sparks, pour out of the mouth of the converter. The iron ladle is drawn out of the way to receive a new load of metal, and the converter is swung slowly back until it has reached the vertical position. The molten metal now rests on the bottom of the vessel, but is prevented from filling the small holes in the bottom by the pressure of the air, which rushes up in numerous streams through the molten bath, causing it to boil violently and burning away all its carbon and silicon. After the first few seconds the flame from the converter loses its smoky appearance and assumes an intense brightness, which continues for six or seven minutes. The flame then begins to "drop," which is the sign to the blower that the impurities are nearly all burned out. As the flame drops still lower the converter is again tilted slowly forward until the bath rests once more in the belly of the vessel, and a great shower of sparks is blown acrosss the building onto the steel pourers' platform until the blower lowers the pressure of the blast. During the process the blower has signaled the "scrapper" what materials, chiefly cold scrap, should be thrown into the converter to change the temperature or the quality of the iron. The steel ladle, suspended from a large jib crane, is now swung around under the mouth of the converter, which is tilted still farther down so that the bath of molten steel pours out into the ladle. The jib crane is then swung around on its pivot, bringing the steel ladle directly over the line of waiting mold cars, which run on narrow-gauge tracks in front of the steel pourers' platform. These molds are large, rectangular iron castings, open at both top and bottom. They rest directly on the solid cast-iron "stools" of the mold cars, so that the metal can not run out. The steel pourer adjusts the handle by which the stopper is raised and lowered. One of his helpers, with a bent steel rod, the "pricker," opens up the nozzle at the bottom of the ladle, the stopper is raised, and the steel pours out in a white hot stream into the mold below. As soon as one mold is poured the stopper is lowered, cutting off the stream, and another mold is brought under the ladle, to be filled in the same way, and this is continued until the whole line is filled. By this time a "heat" from another converter is almost ready for pouring, and the converter whose operation has just been described is at work again. This continues throughout the shift, each converter finishing a heat about every 15 minutes.

OPEN-HEARTH DEPARTMENT.

The open-hearth building is entirely different from the Bessemer. Instead of a small compact building with intense incessant activity within, the building is immense and it is not at all apparent that any very great amount of work is being done within. The open-hearth building can always be distinguished by the large number of tall stacks that form a row along one side of it. These stacks carry away the smoke and waste gases from the gas producers, which are an essential part of the open-hearth equipment. The building is always very large, two or three hundred feet wide and sometimes as much as a quarter of a mile in length. It is not nearly so open as the Bessemer building, but in the best arranged plants as much open space as possible is provided and the roof is made very high, with special reference to carrying off the heat and fumes from the furnace operations.

Down the center of the building is a long single row of furnaces, usually from 8 to 16 or more in number. Each open-hearth furnace is a rectangular structure of fire brick 40 feet or more in length, 20 to 30 feet in width, and 10 to 12 feet in height in the portion visible above the floor. At each end of the furnace is a fire-brick extension of the furnace, some 4 or more feet square. These are the ports through which the gas and air enter the furnace. The interior of the furnace consists of a hearth of fire brick lined with magnesite in basic furnaces or with sand in acid furnaces, above which is a low roof, arched so as to bring the flame down most effectively on the charge of metal as it rests on the hearth. At the front of the furnace are usually three wide openings, through which the charge is introduced and through which workmen enter to make repairs. These openings are closed by doors which are raised and lowered by hydraulic or electric power. In most of the more recently constructed plants these doors are hollow, and water circulates through them continuously in order to lower the temperature to which the workmen are exposed. At the back of the furnace is a tap hole with a spout or "runner" beneath, through which the molten metal is drained from the furnace.

In the open-hearth building there are three working levels: (1) The charging floor or level from which the materials are put into the furnace; (2) the pit or ground level, on which are the tracks for the cars carrying the ingot molds and which also provides a place for temporarily disposing of the slag and waste metal until it can be finally removed; and (3) the steel pourers' platform. Above these levels are a number of electric overhead traveling cranes, those of the pit being of great size and strength, so that they can handle expeditiously the immense ladles which contain as much as 75 tons of molten steel. Along the rear of the furnaces on the same level as the charging floor and above the pit is a platform upon which the men work in tapping the furnaces, which in the best arranged plants is very broad and is strongly railed.

Formerly all the materials were charged into the furnaces by hand, a large number of men being required to handle the materials for even a small furnace. It was extremely strenuous and exhausting labor, as the hearth of the furnace was red hot and the doors were raised during charging. At present, however, this work is done away with. A large part of the charge is in the form of molten metal taken from the mixers. This is handled by the overhead cranes and is poured directly into the furnace by means of a movable runner.

The remainder, consisting chiefly of cold scrap, steel, or iron and pig iron, is charged into the furnace by specially designed machines. Each machine consists essentially of a broad, self-propelled platform mounted on wheels which run on special tracks. Moving back and forth on this platform is a carriage from which projects a long steel arm, something like a battering ram, with a head specially designed to engage the fittings on the "scrap boxes" or "pans" in which the material is brought from the stock piles. This arm is also capable of being rotated so that after it has picked up and thrust one of the scrap boxes into the furnace it can turn the box upside down and empty the contents on the hearth of the furnace. The scrap boxes are brought into the building on narrow-gauge flat cars, which run along on tracks directly in front of the row of furnaces. The charging machine is also capable of being moved on its tracks parallel to the row of furnaces, and in this way one machine is made to serve several furnaces, usually from six to eight. The typical modern furnace has a capacity of from 50 to 75 tons per heat, and to charge this amount of material by hand would require a very large number of men working in short spells and exposed to the great heat radiated from the interior of the furnace. With the charging machine under good conditions this is easily accomplished in from 30 to 45 minutes by one machine operator.

After the furnace is charged the amount of time required to complete the process depends upon a large number of elements, and ranges from a few minutes in the case of some heats of "duplex metal" taken from Bessemer converters to 12 or more hours where nothing but cold material with a large proportion of heavy scrap is charged. The normal time required for a heat is from 8 to 11 hours. After the charge is in the furnace and the doors are banked the men on the charging side of the furnace do not have a great deal to do. The first helper reverses the valves controlling the gas and air at regular intervals (usually every 30 minutes) so as to maintain a high and uniform temperature, and from time to time, on the indication of tests taken from the furnace, adds whatever materials are required to bring the bath to the necessary specifications. If the quantities are large, this is done by the charging machine, or, if small, by the first helper, aided by the second and third helpers, or cinder pitmen. The melter, who is practically a foreman in charge of the operations of the furnaces, and the first helper both keep a careful watch of the condition of the bath and by indications known to the eye, verified by various tests, regulate the working of the furnace. As far as working conditions are concerned, the open-hearth department very closely resembles the blast furnace, in that the process requires a great deal of time for its completion, and the duties of the responsible men consist in large part of carefully watching every stage of the process rather than in active work. For this reason some men are nearly always to be found on the benches at the back of the charging floor, resting and apparently idle. They seldom go far away from their own furnaces, however, and even when apparently idle are watchful and alert for duty.

After the final tests are made and the melter is satisfied, as a result of his own tests and those made in the special laboratories, that the metal conforms to specifications, the second helper and the third helper (cinder pitman) go to the back of the furnace and commence to drill the tap hole of the furnace open. They have already, at the melter's order, brought to the back of the furnace the material required for recarburizing the metal and have it convenient, either in paper bags or in some other easily handled form. Only a short time is required to drill the clay and magnesite out of the tap hole, the final drilling being done from the front of the furnace, and then the molten steel comes with a rush through the hole and out through the spout into the ladle placed in the pit beneath the spout. The recarburizing material must be put in at once, before the slag begins to flow, and the helpers devote themselves to this. They seize one of the paper bags containing the lighter and finer materials, such as slack coal, and, rushing into the heat for a moment, cast the contents into the ladle, and rush back for another bag. The heavier materials are shoveled in, the helper protecting himself as best he can while working as rapidly and shoveling as accurately as possible. When the last of the 50 or more tons of molten steel is in the ladle and the slag has run over the edge of the ladle into a slag box or onto the floor beneath, the steel ladle is hoisted by a huge electric traveling crane capable of lifting 100 tons or more and carried across the pit to the steel pourers' platform, where the contents are poured into ingot molds in the same manner that has been described in connection with the Bessemer department.

There is still much to be done before the cycle of producing steel is completed, and as this work embraces some of the severest physical labor left in the open-hearth department, it is proper to point it out here. As soon as the steel is out of the furnace, the men on the charging floor begin the work of repairing and patching the interior of the furnace which has been injured by the heat and chemical action. Before this can be done, however, it is frequently necessary to take long iron bars with wooden blocks on the end and splash the slag, which is below the level of the tap hole, out of the furnace. When all is ready they begin to throw in with shovels or to place more accurately with long-handled "spoons" the patching materials at the points that show wear. As the furnace is still red hot within and the doors must be open during this work, it is necessary for the men to work in very high temperatures and to relieve each other at frequent intervals. This work usually takes from one-half to three-quarters of an hour to complete.

In the pit also there is a good deal of work to be done, for much slag and some metal has probably been spilled on the ground, and this must be loosened and broken up so that the cranes can carry it away. In the best managed of the modern plants, however, work of this nature has been reduced to a minimum by various simple methods, which will be described later on.

Before the visitor has seen these operations completed the work of charging the next heat is already beginning, and another furnace, if it is a very large plant, is probably ready to be tapped. This completes the cycle of operations in the open-hearth department. From this point onward the metal is handled not in a molten but in a solid state. From this time forward also it is a matter of little consequence whether open-hearth or Bessemer steel is being handled, for both receive the same treatment. Trains of small cars, on each of which are three ingot molds containing rapidly solidifying steel, are continually being hauled out of the open-hearth and Bessemer buildings by diminutive but powerful locomotives ("dinkeys") and carried away to the "ingot stripper," where the molds are removed from the red-hot ingots, which by this time are thoroughly solidified on the surface.

THE INGOT STRIPPER.

The "ingot stripper," in addition to having considerably reduced the cost of manufacture and greatly contributed to uniform operation of the rolling mills by the elimination of delays, has relieved the industry of some of the most severe manual labor which it formerly required. Until the invention of the "stripper" the molds were removed by hooking the crane chains onto the molds (in itself a hot and disagreeable task), and then hoisting the molds in the air. Owing to the taper of the molds and the contraction of steel by cooling most of the ingots came out without difficulty, but many stuck in the molds. In the case of these "stickers," two of the pitmen had to take heavy sledges, and going up within striking distance of the mold, which contained the red-hot ingot, sledge at the mold until the ingot loosened and fell out. Words can not depict the conditions under which these men worked in the old subsurface pits of former days, to which no breath of fresh air could penetrate.

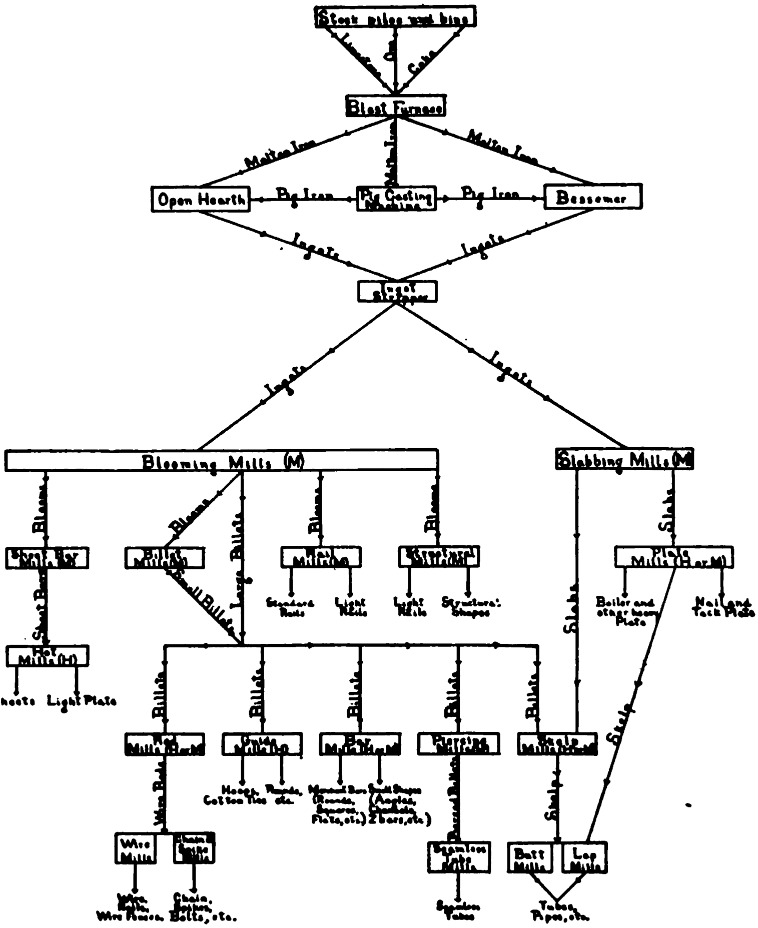
The "ingot stripper" is comparatively simple in its essentials. The innovation consisted practically in replacing the crane chains by solid arms which can be moved in and out under control from the crane cab to grasp projections or lugs cast on the sides of the ingot molds. This avoids the hooking on of the crane chains. The sledging was eliminated by introducing a massive plunger driven by hydraulic or electric power, which, also under control from the crane cab, can be pushed down through the open top of the mold to force the ingot out if it sticks. After removal from the ingots the molds are placed on empty mold cars waiting on parallel tracks, and except for an internal wash of clay or a spray with some tarry mixture are ready to be returned for more ingots. The "ingot stripper" is covered by a roof in most plants and the crane cab is replaced by a stationary platform, from which the movements can be more easily controlled, but the essential principle is the same. The ingots mounted on the cars are drawn by locomotives to the blooming mills or to the slabbing mills.

ROLLING MILLS.

The ingots cast in the Bessemer and open-hearth departments are not finished products in any sense, but merely raw material for the rolling mills.

The purpose of the rolling mills is to reduce the crude steel ingots to the forms and shapes required in the arts. The process of rolling serves the additional purpose of improving the texture of the metal by working it under heavy pressure. While it would be possible to cast many of the shapes into which steel is rolled, the cast metal would not possess the requisite strength and quality. On account of the great variety of their products, rolling mills differ greatly in size and type. The interrelations of the various types of rolling mills, as well as their relation to the other departments of the plant, are shown in the form of a diagram. This diagram is not intended to cover the steel industry but simply to indicate the relations of the departments in a modern large steel works. For this reason the puddling, crucible, and various minor processes have been omitted, as they are usually carried out in plants specialized for the purpose, and their inclusion here would merely complicate matters. The diagram is based upon the relations between the products of the different mills and departments.

With the aid of this diagram which is presented below the reader is enabled to sum up briefly the relations of the departments which have been described in the preceding pages:



The Steel Industry

Diagram showing interrelations of Departments and Products.
Type of Rolling Mill indicated by (H) Hand Mill, (M) Mechanical Mill.

As shown in the above diagram all production starts with the blast furnace, the entire product of which in the modern steel works goes to the open-hearth or Bessemer department either as molten iron in ladles, or in the shape of solid "pigs" which have been cast in the casting machine. In the Bessemer and open-hearth departments the iron is refined into steel, which is cast into ingots. At the ingot stripper the molds are removed from the ingots, which go either to the blooming mills or to the slabbing mills. The blooming mills and slabbing mills, although differing slightly in form and in the shape of their products, perform essentially the same function, namely, to reduce the ingots to a more manageable size and shape. In the slabbing mills the ingots are rolled into large slabs, which are still further rolled down in plate mills to plates of various thicknesses.

In the blooming mills the ingots are rolled either into "blooms" or into large "billets." They are simply rough pieces of steel of a square or rectangular section and of varying length. The "bloom" and "billet" do not differ in any particular except size, pieces having a cross section of 36 square inches or greater being usually known as blooms, and those of a smaller cross section as billets. These two forms, blooms and billets, are not in any sense finished products, but form the basis for all later rolling-mill work. The lines which the blooms and billets may take from this point vary widely according to the particular product which is to be rolled. In order to avoid confusion it is necessary to follow them one at a time.

The finishing mills, for which the blooms, billets, and slabs form the raw material, fall into two general classes: First, the large mills for rolling heavy finished products, such as rail mills, structural mills, sheet-bar mills, and plate mills; and, second, the small mills for rolling light products, such as hoop mills, merchant mills, and rod mills. To consider first the large mills it may be noted that rails and structural shapes are usually rolled in mills specialized for the purpose, although a simple change of rolls is all that is necessary to transform a rail mill into a structural mill or vice versa. In Europe it is quite common to use the same mill for a great variety of products, but it is seldom done in this country. In other specialized mills the blooms are rolled into "sheet bars," from 7 to 9 inches wide and three-eighths to one-half inch thick. These "sheet bars" are used in rolling sheets and light plates from which tin plate and similar products are made. The heavy plates, it will be remembered, are rolled from slabs in plate mills specially designed for this purpose.

A large part of the output of the blooming mills is consumed in various types of small mills.[1] These small mills may be divided into two general classes, "bar mills" and "rod mills." The rod mills are specially designed to produce a single uniform product at maximum speed, while the bar mills turn out a great variety of shapes and sizes. Bar mills are further subdivided on the basis of their products into (1) "hoop, band, and cotton-tie mills;" (2) "merchant mills," which roll the various kinds of material which an iron merchant is supposed to keep in stock; and (3) the mills which roll various small shapes and special products. It is almost impossible to secure a satisfactory classification of rolling mills, but the brief outline given above should serve to make clear the relations which exist among the various mills.

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[1] If these small mills use large billets, 4 by 4 inches, for example, the billets are rolled directly in the blooming mill, but if smaller billets are required the blooms are sent for further reduction to special mills known as "billet mills."

There are few plants in which will be found all the different types of rolling mills which are considered in the following pages, but for convenience of description and to show the relations between the different mills, they will be treated as if all were in one large plant.

MECHANICAL MILLS.

BLOOMING MILLS.

It is always easy to locate the blooming mills and slabbing mills by following the cars with the red-hot ingots mounted on them as they are hauled away from the ingot stripper. No time is lost in hauling the ingots to the blooming mill, for it is desirable that little of the initial heat shall be lost before the ingots are put into the "soaking pits." The nature and purpose of these pits will be considered later, but first it is necessary to describe the general appearance of the mill building and its internal arrangements. As all the rolling-mill buildings are of the same general type, this description will serve for all.

The rolling-mill buildings are usually very large, not only because of the lower cost of construction through the elimination of side walls, but because of the better ventilation, light, and general arrangement possible in the large building. Therefore, it is the usual practice to assemble several small rolling mills, each of which occupies little space, in a large building, rather than to give each of them a separate building. There are also certain economies as regards power, furnaces, and disposition of material which favor the grouping of small mills.

The typical rolling-mill building consists of little more than a specially ventilated roof of great expanse, supported on a strong steel framework. The windows just under the eaves of the roof and along the side walls are pivoted so that they may all be thrown open in the summer to provide additional ventilation. To lay so much stress on ventilation in a building which is open on all sides may seem strange, but, as a matter of fact, the amount of heat and smoke to be disposed of is so great that without good roof ventilation the conditions inside such a building on calm, sultry days are very bad. This statement will be understood after a visit to some mill in which the constructor paid no attention to ventilation and the disposal of smoke. A great deal of attention has been paid to these features of construction in recent years, and the modern mill building is far superior in every respect to those constructed 20 years ago. Some of the buildings are indeed marvels of engineering construction and show close attention to the points of ventilation and sanitation alluded to above.

The buildings are usually two or three times as long as they are wide, in order that the material may pass through the mill directly in a straight line and thus avoid side transfers, which waste time and require expensive machinery. Where plants, particularly those located in cities, have outgrown the space originally provided for them, this consideration must often be ignored in the installation of additional mills, and the result is a cramped and confused situation, which is the abomination of every superintendent and the cause of very hazardous and highly uncomfortable working conditions.

So much for the general type of construction. Outside the blooming mill is a long line of red-hot ingots waiting to be transferred to the soaking pits. From within comes the heavy rumble of the great rolls, as pressure is applied to the ingot, broken by the shrill call of whistles signaling above the din of the mill, and the harsh clang of the warning bells on the cranes and ingot cars. Entering the mill where the smoke is thickest, it is seen that this entire end is given over to rows of deep pits, red hot within, from the mouths of which smoke and gases pour out under the edges of heavy fire-brick covers. These are the "soaking pits." As the covers slide back it is seen that some of the pits contain ingots standing upright, their tops being just below the surface, while other pits are empty. These empty pits are rapidly filled, however, by an overhead crane, which seizes an ingot resting on one of the cars with a pair of powerful tongs, swings it across the building, lowers it quickly and accurately into the empty pit, and swings back again across the building for another ingot. When four ingots have been placed in the pit, the cover is slid back and another empty pit is opened. From the full pits another overhead crane is removing the ingots one by one and placing them on a special car by which they are carried to the roll table.

The purpose of the soaking pits is as follows: While the red-hot ingots as they come from the Bessemer or the open-hearth departments are solidified on the surface, their interior is still in a molten condition. If the ingots in this condition were put through the blooming mill, either the molten metal would squirt out through the skin onto the workmen when pressure was applied or the molten interior would flatten out faster than the relatively cold skin and produce a cracked, distorted mass instead of a square solid bloom. In order to equalize the temperature throughout the ingot and to bring the entire mass to a proper rolling heat, the ingots are placed in the "soaking pits." The pits are of fire-brick construction and each usually contains four ingots. In Europe, where fuel is more expensive, such arrangements are made that no additional heat is applied, and the ingots are brought to a uniform rolling heat by being allowed to "soak" for some time, on very much the same principle used in the "fireless cooker." This has never been the practice in America, the additional cost of fuel for heating the soaking pits through the regenerative system being held to be balanced by the ability to shorten the process and to keep the temperature better under control.

From the soaking pits the ingots go to the blooming rolls. These rolls are of massive construction, each roll usually being from 36 to 48 inches in diameter, and the framework (housing) in which they are mounted is likewise of great size and solidly built throughout. The rolls, it will be noted, are not smooth cylinders, but have large grooves cut around their surfaces, leaving several collars at different distances, so that when the upper and lower rolls are brought together a series of holes (passes) are left between them. These passes are rectangular in blooming mills, and they not only make it easier to give the bloom a true rectangular shape, but also make it possible to have two pieces of different sections in the mill at the same time. The type of mill most likely to be seen is of the "reversing" or "two-high" type, so called because there are only two rolls placed one above the other. Consequently, in order to roll the ingot back and forth under pressure until it is reduced to proper dimensions, the direction of rotation of the rolls must be reversed each time the ingot is passed between them. This is the more common type, although "three-high" blooming mills, having three superposed rolls, are also used, in which reversing is unnecessary, the ingot being returned under pressure between the upper and center rolls.

Both in front of and behind the stand of blooming rolls is a huge steel table equipped with large cylindrical rollers set parallel to the rolls, the rollers being connected by gearing along the side of the table so that they can be revolved in either direction. The table in front of the stand feeds the ingot into the rolls and as it emerges the ingot is caught on the rear table. A reversal of the mechanism carries the ingot back between the rolls for another pass. If the mill is three-high these tables must be fitted with powerful mechanism so that they can be raised bodily to the top of the center roll or so that the end nearest the rolls can be tilted up to this height. On close observation steel projections (fingers) will be seen extending up between and just above the level of the rollers at several points on the table. These are the fingers of the "manipulator," by which the ingots are turned over or transferred from side to side on the tables.

The mechanism with which these fingers are connected below the surface of the table is so arranged that the fingers may be raised or lowered or moved across the table under the control of a pair of levers.

On the side of the blooming rolls opposite the soaking pits is a long conveyor table similar in general appearance to the roll table, except that it is stationary. By this means the ingot, after it has been rolled down to a bloom or billet section, is carried down to the shears to be cut into small pieces.

The blooming-mill shears are as massive as the rolls, for with them blooms 8 by 8 inches or larger are cut. The bloom shears are usually operated by hydraulic mechanism, the bloom being " bit off " between the edges of two massive blocks of hardened steel, rather than cut. No hotbed is necessary in the blooming mill unless the blooms are taken directly without shearing by a billet, structural, or rail mill. A hotbed may then be necessary as a storage place in case the second mill is delayed or shut down.

After the ingot is removed from the soaking pits by the crane it is placed in a special receptacle on the electrically operated ingot car, by which it is carried to and deposited on the roll table. The ingot cars are usually operated by boys, who are screened from the heat and flying scale. The receptacle in which the ingot is carried is arranged to tilt forward when it reaches the roll table and dump the ingot out onto the table. The rollers of the table are then set to revolving and the ingot moves along the table, small end forward, until it strikes the rolls. As the rolls grip the ingot the scale which has been formed on the ingot by oxidation is thrown violently backward by the rotation of the rolls. The ingot is drawn rapidly through the rolls and plunges out onto the table on the opposite side. As soon as the ingot is out on the table it is turned over on its side by the manipulator, the direction of the table rollers is reversed, and the ingot is carried back between the rolls under heavy pressure. This is repeated several times, the piece being turned on its side as soon as the reduction in any one direction is sufficient. With each pass the section is rapidly reduced and the piece is correspondingly increased in length, the rapidity with which the ingot is rolled depending entirely on the size and power of the mill. Before the rolling of one ingot is completed, however, another ingot is already being rolled, the first having been shifted from the entering pass to the successively smaller passes between the rolls as its section was reduced.

At first sight the intricate movements of the rolling mill and the ingot appear to be automatic, as no workman has been seen, unless by chance the ingot has been turned around on the table beyond the reach of the manipulator, in which case the " table man," or " hooker," as he is sometimes called, who has been watching from a little distance, runs up close to the table and with a long hook or bar pulls the ingot around straight. There are a few blooming mills which are not provided with manipulators, where table men stand on the edge of the table and turn the ingot over each time it passes through the rolls, but they were built many years ago, and none is likely to be built hereafter in which work of this dangerous and exhausting character is necessary. This is the only occasion on which the ingot is handled directly by workmen, all other movements, both of the rolls and of the table, being controlled by two or three men working on an elevated platform (the pulpit) not far from the rolls. Along the front of the pulpit will be seen a row of levers, each man having a certain number under his control. The division of work among the men varies, but typically it is as follows: The first man, or "roller," who is in general charge of the mill, operates the levers for controlling the rotation of the table rollers, and also those for regulating the distance between the upper and lower rolls. The "roll engineer," if it is a two-high reversing mill, operates the throttle levers controlling the reversing engines, by which the direction and speed of rotation of the rolls are governed. The "manipulator," or "table lever man," operates the levers which control the manipulator mechanism and, if it is a three-high mill, the levers which control the mechanism by which the table is raised and lowered. These men must be constantly watchful and work together as a team, for their movements must be perfectly coordinated in order to secure rapid production. Improvements of equipment have done much to facilitate their work, and better mill arrangements have made their position less uncomfortable than it was in some of the old mills, where their pulpit was directly over the table; nevertheless the work is still hot, difficult, and, with 12 hours of steady rolling, exhausting.

RAIL, STRUCTURAL, AND OTHER SHAPE MILLS.

As has been indicated above, the blooming mills are frequently operated in connection with rail, structural, or billet mills, in which the steel is rolled down without shearing into smaller sections. The rail or structural mill consists of three or more stands of rolls, differing from those in the blooming mill in being of smaller size and in the fact that the grooves, cut into the rolls, form passes of the shapes which are to be rolled. In many cases, however, the blooms are sheared and must be reheated before being rolled. The reheating is done in horizontal fire-brick furnaces, usually heated by gas, and are carried to the rolls on conveyor tables similar to those already described. The structural and rail mills usually have three-high rolls throughout except at the finishing stand, where the material is given only a single pass. In order to facilitate the entrance of the pieces into the intricately shaped passes, bell-mouthed guides are placed on the entering side of the rolls just in front of the pass.

None but the simplest shapes can be sheared; all others are sawed while hot. To expedite the process gang saws are frequently used, so that two or more cuts are made at the same time. After sawing, the material is run out onto the hotbed to cool before it is straightened and punched. The hotbed consists of a steel framework, on top of which is a long series of rails laid parallel to form supports for the sawed material. Between the rails are endless-chain conveyors having fingers which project above the surface of the hotbed so as to catch the cooling beams or rails and carry them along the hotbed toward the finishing end of the mill. At the finishing end of the mill the rails or structural shapes are first inspected, all surface flaws are chipped out, and the ends are filed or otherwise dressed to remove the burrs left by sawing. They are then straightened either on a gag press or, if light and of simple section, by a roller straightening machine. The holes for rivets or bolts are next punched or drilled, depending on the thickness of the material, and the rails or beams are ready for shipment. The loading is done almost altogether by cranes, either with magnets or with specially shaped tongs.

For a more detailed account of the operations in such mills, both in rolling and in finishing, the reader is referred to the detailed description of occupations, Volume I, pages 206 to 211.

BILLET AND SHEET BAR MILLS.

The other large mechanical mills for producing billets, sheet bars, and other semifinished material are similar to those already described, except that the finishing department is lacking. It is, therefore, superfluous to describe them. One point may, however, be noted in connection with them, namely, the tendency to place the stands one behind the other rather than side by side as was formerly the custom. This makes the problem of transferring the material from one stand of rolls to the next very much simpler and also makes possible the elimination of a number of workmen required to operate the transfer mechanism and to guide the pieces into the rolls properly. With the straight-line method of arrangement the piece passes straight through the mill from one end to the other without being touched or in any way controlled when the mill is working properly. The great difficulty at first with this type of mill was in the arrangements for turning the piece over so as to insure proper working from all directions and in properly coordinating the speeds of the different sets of rolls so that as the piece increased in length in the successive passes the peripheral speed of the rolls would be increased so as to prevent buckling. The first difficulty was surmounted by the use of the twisted guide by which the piece is given a quarter turn in much the same way that a bullet is caused to rotate in a rifle barrel. The second difficulty has been greatly simplified by the use of electric motors for driving the rolls. This system of operation possesses many great advantages and in the new works at Gary, Ind., it has been applied to a combination blooming and rail mill. The ingot is there rolled between alternate stands of horizontal and vertical rolls until it has been reduced to an 8 by 8 inch section, when it is put through a twisted guide. It is interesting to note in connection with this particular mill that the first time a hand tool is used in handling either the materials or the product, from the ore mine through the rolling mill, is when the half-finished rail is turned partly over on the hotbed by the hotbed man, in order to allow it to cool more uniformly.

SLABBING AND PLATE MILLS.

The slabbing mills serve the same general purpose as the blooming mills, namely, that of reducing ingots to pieces of smaller size and giving the steel a preliminary working. The equipment of soaking pits, roll tables, and cranes are generally similar. The chief difference is in the stand of rolls. The horizontal rolls used in the slabbing mill are smooth cylinders 6 or 7 feet long. In addition to the horizontal rolls there are two vertical, power-driven rolls, which make it possible to roll the piece on all sides without turning it over, as was seen to be necessary in the blooming mills. The addition of these vertical rolls causes the slab mill to be known as a "universal mill." There is also one spectacular difference in rolling. It is essential that the surface of the slab shall be perfectly smooth and free from the oxidized scale which forms on the ingot. This scale is removed by a very simple process. After the slab has been passed through the rolls once or twice and the greater part of the scale knocked off, salt is sprinkled over the surface of the slab. This salt absorbs the water which flows down over the rolls. As the slab passes between the rolls this absorbed water is suddenly converted into steam, causing a series of explosions which blow the scale violently off the slab.

The slabs are rolled into plates in the plate mills, which are of three general types: (1) Sheared plate mills; (2) universal plate mills; (3) narrow plate mills of various types. The sheared plate mills, on which plates 6 feet wide and upward are rolled, consist usually of a single stand of two-high or three-high rolls. In order to roll a plate 6 feet wide, the barrel or smooth part of the roll must be several inches wider. The rolls are not true cylinders, but are appreciably larger at the center than at the ends in order to take up the bend that is produced in a roll of this length in spite of its large diameter. Both in front of and behind the stand of rolls is a roll table similar to that described in connection with blooming mills (p. 60).

As the distance between the rolls must be frequently and accurately adjusted during the course of rolling in order to produce plates of the exact thickness specified, special mechanism for accomplishing this adjustment is provided. This is the "screw down" mechanism which is located on top of the housing of the stand of rolls. The mechanism consists essentially of a large threaded shaft at each end of the housing, which is connected with the upper roll in such a way that its rotation either raises or lowers this roll. The rotation is accomplished by means of a large geared wheel which meshes with a toothed rack operated by hydraulic or electric power under the control of levers in the roller's platform. The distance between the rolls is indicated on a large dial on one side of the stand of rolls.

The universal plate mills, on which plates with smooth edges can be produced by shearing, are of exactly the same general type as the slab mills described above except that they are less massive, because the material to be handled is much lighter. The vertical rolls in mills of this type roll the edges of the plate at the same time that it is being reduced in thickness by the main or horizontal rolls.

The mills on which narrow plates and skelp are rolled are of many different types, but the most efficient modern mills are of the "continuous" type with the stands of rolls placed one behind the other. In mills of this type the labor force is reduced to an absolute minimum, and to all appearances most of the few workmen who are seen about such a mill are idle. This is, however, entirely a matter of appearance, for their duties consist in giving the operation of the mill their closest attention, and they are always alert to correct any of the defects in operation which are constantly occurring even in the best arranged mills. These operating troubles are frequently very slight, but even the slightest derangement in a mill so delicately adjusted suffices to entirely disturb its operation and to ruin all material that may go through until the proper adjustments or repairs are made.

Next to the quality of the steel the three points of greatest importance in plates are the "gauge" or thickness, the smoothness and equality of the surface, and the accuracy with which it is sheared to the proper dimensions. These requirements in large measure suffice to differentiate the operation of the plate mills from other rolling mills. While the plate is being rolled a close observer will notice that the roller frequently goes to the roll table and with micrometer calipers of special design gauges the plate carefully and on the basis of his reading gives the proper orders to his rolling crew. The plate is given a smooth surface by exercising care that the surface of the rolls is always perfect and by the removal of all scale from the surface. As in the slab mills this scale is removed by throwing salt on the plate, which absorbs some water, so that as the plate passes between the hot rolls the steam generated under pressure causes a series of deafening explosions which blow off the scale with great force. Some of the scale is also removed with wire brushes which are rubbed over the surface of the plate between passes. The inequalities in cooling of a piece of metal with such a large surface as a plate cause it to "buckle" seriously. If these waves in the surface were not removed the plate would be almost useless for all practical purposes. This removal is affected by the straightening machine. This device consists of two series of rollers one above the other. As the plate passes slowly between these two series of rollers just enough pressure is exerted to counteract any buckling and to bring the plate out very nearly cool and perfectly flat. As it comes from the straightening machine it passes out onto a roller conveyer which carries it down to the shears. During its passage to the shears it goes through the hands of a series of men, all of whom are very rapid workers, who give it proper designating marks to indicate the order, the size of pieces to be sheared and all other facts required for its future handling, and who also rule on its surface lines which indicate to the shearman where it is to be cut.

The shearing of plates is quite a different matter from the shearing of other steel products. In the case of plates every line must be accurately cut or a valuable piece of steel on which much labor has been expended will have to be thrown on the scrap heap, unless it can be utilized to fill orders for small sizes. The shear used resembles a guillotine of tremendous proportions, with a knife 7 or more feet long and with a very massive framework. The plate is brought to the shear from the conveyor by being pushed along by the shear gang on top of what are called "goosenecks," but which resemble huge furniture casters mounted on inclined bars. There is a large number of these casters on each side of the shears, and, turning easily in all directions, they form a very efficient means of handling the unwieldy plates. In addition to these large "guillotine" shears there are many other types of shears by which special shapes are cut, as well as punches for forming rivet and bolt holes in the plates in accordance with the specifications of the order. It would require much space to adequately describe this equipment, and for the present purposes such a description is unnecessary. It is important, however, for the reader to know that in the plate mills there is usually a larger number of men in the shearing and finishing end of the mill, where moderate temperature conditions prevail, than in the unusual heat of the mill itself.

HAND MILLS.

All the mills described above have been of the "mechanical type," where practically all handling of materials and products has been done by various mechanical devices. The mills which must now be considered are the so-called "hand" mills, similar to those which have been described as characteristic of the small rolling-mill plants throughout the country and generally the only type known in the industry 40 years ago. These mills fall into three general groups—first, the bar or guide mills; second, the rod mills; and, third, the sheet mills, or "hot mills," as they are known in the industry. In general principle of operation the bar and rod mills resemble each other, and in many cases the line of demarcation between the small guide mills and the rod mills can be drawn only on the basis of the particular product made at the time. Nevertheless, the demand for wire rods is so great that special types of mills have been developed for their production, and it is consequently proper that the differentiation should be made.

BAR AND GUIDE MILLS.

Until recently the equipment of the bar mills was very simple and fairly uniform, consisting, as it did, essentially of furnaces, a train of rolls of three or more stands, and a hotbed, which was little more than a continuation of the cast-iron plates which form the floor of the mill. All the material in such mills is handled by hand, with practically no mechanical aids except tongs, hooks or bars, and small trucks. The bar mills are usually housed in comparatively large buildings, two or more mills frequently being brought together under a single roof in order to economize space and to facilitate the handling of the products. Generally the mill buildings have high roofs with sufficient ventilating means to carry off a great part of the heat from the mills, but in many cases the buildings are badly cramped and the roofs are so low that the hot air from the furnaces and the hot metal can not escape except when a very high wind is blowing. The floors of such mills are uniformly made of cast-iron plates, which are necessary on account of the hot metal handled, but which are a source of extreme heat, particularly during the summer months. The floors in summer are so hot as to be a source of discomfort to the visitor with moderately thin-sole shoes. The workmen protect their feet by wearing shoes with heavy soles, either of wood or leather.

In contrast with other rolling mills which have been described, where very few workmen are to be seen, the bar mills impress the visitor as being extremely busy places. Workmen are to be seen in all parts of the mill engaged in manual labor. Upon close observation it will be seen that these workmen fall into three groups—the furnace crew, the roll crew, and the shipping crew. The material used in such mills consists of billets, which are square pieces of steel varying in cross section generally from 2 by 2 inches to 5 by 5 inches and in length from 2 to 5 feet. The billets are brought from the stock yard, where they are kept in carefully labeled piles, to the mill on small trucks and placed in a position from which they can be conveniently charged into the furnaces. The furnaces used for reheating the billets in bar mills are all small, and while from a technical point of view there are a great many separate types, for the present purpose only two principal types need to be distinguished—(1) the old-style noncontinuous furnace, in which the billets were charged and drawn from the same side, and (2) the modern continuous furnace, in which the billets are charged at one end of the furnace, pass directly through it, and are discharged automatically at the other end of the furnace.

In addition to the decided lack of economy in the older type of furnaces they possess a further disadvantage in that the furnace has to be charged and the billets allowed to heat while the hot billets for the rolling mill are taken from another furnace. Thus more than twice as many furnaces are necessary to supply the rolling mill as are necessary where furnaces of the same size are run on the continuous system. As the capacity of the rolling mills increased and they were run at a higher speed it was necessary to have a very large number of furnaces in order to give a constant supply of properly heated billets. This produced congestion at the furnace end of the mill and made, besides, a very hot working place, the furnaces forming an inclosure to which hardly a breath of air could penetrate. Even with the largest number of furnaces which could be crowded into the mill, there were long delays during which everybody but the heating crew was idle. In the modern rolling mill these difficulties have been eliminated by the use of the continuous furnace. In this furnace the metal is pushed through the furnace along an incline of water-cooled pipes, all of the work of pushing the billets being done mechanically. On the old-style furnace, where the metal is charged and drawn at the same side of the furnace, two separate gangs of men are usually seen at work. One of these gangs, the chargers and the stockers, are engaged in placing the billets in the furnace to be heated. In doing this the men, sometimes alone, sometimes assisted, pick up the billet with tongs, which are usually suspended from an overhead trolley, and place the billet on the flattened end of a long iron bar, known as the "peel,' which is handled by other men. This peel, which rests on a roller, is run well into the furnace and the billet deposited at one side near the back of the furnace. This is continued until the entire hearth is covered with billets. As the furnace is heated at this time the door must be kept closed as much of the time as possible. This is done by a boy who stands near one end and operates levers or chains controlling the raising and lowering of the doors. While the doors are up, however, the men are exposed to extreme heat and the work, which is very strenuous, must consequently be done under heat conditions which can be endured for only a short period. In doing this work, however, the men are usually under no pressure and, consequently, stop work for a short time when the heat becomes unbearable.

The working conditions under which the other gang of men who draw the billets and take them down to the rolls are very different. These men must work at top speed, for the billets must be drawn when they are at the proper heat, and furthermore, the production of the material and the earnings of all the tonnage men depend on the promptness with which the steel is taken to the rolls. If the billets are small and easily handled, they are simply swung out of the furnace with long tongs and thrown sliding across the iron-plated floor to the roughing rolls. If they are of larger size, they are either carried down with tongs suspended from an overhead trolley or wheeled down on small iron trucks. This work is so strenuous that the men can not do it for more than half an hour at a time. Frequently in summer the sweat literally pours off their faces, blinding them if it goes into their eyes and, together with the intense heat and illumination from the glowing interior of the furnace, leaving their eyes almost invariably bloodshot at the end of a hard days' work. This work is lightened by the fact that, except where there are long delays on the mill, relief crews or " spell hands " are provided who relieve these men at the end usually of every half hour.

With continuous furnaces this strenuous labor is eliminated. The metal is charged by mechanical pushers which shove the billets in an unending line through the furnace, pushing them out on the other side onto a motor-driven roller conveyer which receives the billets as they fall and carries them to the rolls. The continuous furnace also possesses advantages, in that fewer furnaces are necessary and consequently the total heat generated is much less and more air can get to the few furnace men who are employed.

The roll train used in the bar mills usually consists of three or more stands of rolls placed end to end in a straight line so that all can be driven by one engine without the need of gears. The rolls used are anywhere from 7 to 20 inches in diameter, though the usual size is from 8 to 14 inches. Although each stand in such a mill usually has its own distinctive name, for practical purposes they may be divided into three groups, the roughing rolls, the intermediate or stranding rolls, and the finishing rolls. The roughing rolls almost always consist of one stand of three-high rolls, as the billet must be passed back and forth through this stand until it is considerably reduced in section. Both the intermediate and finishing rolls, however, have two or more stands which may be only two-high if the metal passes through each stand in only one direction. In the smaller mills and sometimes in the bar mills funnel-shaped guides are placed in front of the passes or grooves in the intermediate and finishing rolls to help the workmen in entering the piece properly and to protect the metal. On the opposite side of the roll from the guides are placed flat pieces of steel or "guards" to prevent the piece of metal from wrapping around the roll and coming out on the side where it was entered, with the probability of seriously injuring the workmen and badly damaging the material.

The operation of rolling a bar proceeds roughly as follows: When the red-hot billet is brought down from the furnace it is grasped with tongs by the "rougher," who stands on the furnace side of the roughing rolls. He lifts the billet slightly and puts it into the largest of the passes formed between the middle and lower rolls by the grooves cut in their surfaces. Usually the billet is gripped by the rolls and carried through without difficulty, but if not the rougher throws his weight behind it, forcing it into the pass until the rolls pull it through. As the billet issues on the other side slightly reduced in section, it is seized near the end by a second man known either as the "catcher" or "rougher up" who lifts it and puts it into the pass between the middle and upper rolls, which carry it back to the side on which it started. If the billet is large the roughers are assisted by hookers, who have long bars hooked at the end and suspended by a chain near the center. These bars are inserted under the billets, using the chain suspension as a fulcrum, and the weight of the hooker is thrown on the other end of the lever thus formed. The billet is thus passed back and forth through the rolls, each time through a new and smaller pass, by the rougher and catcher until it is considerably reduced in section and perhaps ten times as long as at the start. When the proper section is reached the end of the now elongated and flexible piece is seized with tongs by another man, the "strander," as it issues from the rolls, swung around in a loop and inserted in the guide in front of the proper pass of the stranding rolls. As it comes out on the opposite side another strander seizes it and, looping it again, inserts it in the proper pass. This work has its own peculiar dangers, because in performing it the strander stands inside the loop of red-hot metal. If a twist is formed in the bar in the first set of stranding rolls, thus causing it to be suddenly stopped, the second stranding set, in which the front end of the bar has been inserted, will quickly tighten up the loop and draw it close to the workman standing within. He is usually protected from the piece reaching his body by a heavy iron pillar erected behind him. Sometimes, however, if he is working very rapidly and is somewhat careless he may neglect to put the loop behind this pillar, in which case if there is a sudden stoppage the loop tightens up, and this means almost certainly a very serious injury for him. There is a further danger connected with this work in that the ends of the rods frequently split. Such split ends should be cut off by the workmen either with the automatic shears which are usually provided in fast mills at each stand, or with a hatchet. If this is not done only one part of the split end may enter the pass and be drawn between the rolls while the other part of the bar is driven forward by the speed of the rolls not through the pass but over the rolls, causing great danger to the workmen on the other side. Instances have occurred where the split end of a bar has penetrated a workman's body and resulted in fatal injury.

When the mills are run at very high speed, as most of the small guide mills are, it becomes very difficult to give each bar the necessary inspection to be sure that the ends are not split. Furthermore, the workmen may not shear off quite enough of the end in inserting the bar into the shears, and there is no time in the rapidly running mills to stop to make a second attempt, for by this time a second bar would be coming through the rolls, which it is his duty to receive.

This looping of the bar is continued generally through several stands in succession in the smaller mills, the bar being continually reduced in section and greatly elongated. When the last or finishing pass is reached the bar is usually allowed to run out along the floor in a straight line, the finishers seizing it this time at the rear end and returning it without looping into the finishing pass. This slight pause allows the metal to oxidize or form a "scale" on the surface, and this scale is removed in the final pass, leaving a smooth-finished surface. As the piece emerges from the finishing pass it is caught with tongs by men, or sometimes boys, who are known as "hotbed men" or "drag outs," and dragged over the cast-iron plates which form the "cooling bed" or, as it is more generally called, the "hotbed." On the hotbed the pieces are laid out in straight lines and allowed to cool. The work on the hotbed, as may be easily understood, is done under conditions of considerable heat, for not only is there a great deal of heat radiated from the hot metal, but the cast-iron plates themselves are always at a very high temperature, and it is over these plates that the hotbed men must walk in dragging the bar to its proper place. This whole crew of men, including both the roll hands and drag outs, are under the immediate supervision of the roller. He is also generally responsible for the entire operation and the quality of the product of the rolling mill. If the mill is running properly he is not a busy man, but if anything goes wrong he sets to work with the rest of the crew to right it as soon as posssible. His position requires, chiefly, long experience and familiarity with the working conditions and requirements of the mill, and, on account of his responsibility, he is well paid for knowing at once what is wrong and what is the quickest way to correct the difficulty.

In the finishing end of the bar mill, which is usually a large comparatively open space, a very large number of men are to be seen cutting the bars into lengths on small shears or circular saws, bundling the cut rods, and preparing them for shipment. Laborers are busy with hand trucks hauling material from operation to operation and finally into the waiting box cars or, if the material goes into stock, to the warehouse. The heat, smoke, and other debilitating and unpleasant features of the mill hardly affect this group of men, except in a few badly planned and constructed mills.

ROD MILLS.

The general equipment of the rod mills is much more elaborate and highly developed than that described for the bar and guide mills. With the growing use of the telephone and the employment of wire for fencing, the demand for wire rods has become so great that it requires mills of large capacity to produce a sufficient quantity. The production of wire rods increased from 846,291 tons in 1900 to 2,240,830 tons in 1910. The great development that has taken place in these mills will be appreciated when it is known that in 1880 a mill could not turn out more than 30 tons of rods in 24 hours; while now mills with rolls of the same size but with a somewhat larger rolling crew turn out 400 tons or more of such rods in the same length of time.

These changes have come about through progressive developments of the equipment in every part of the mill. Furnaces capable of economically providing the required steel without delays have been devised, additional stands of speedier and stronger rolls have been added, and various devices have been introduced to make the handling of the material at the rolls as nearly automatic as possible, while the methods of disposing of the finished material have been revolutionized.

The furnaces used in rod mills are practically all of the continuous type, and so completely provided with mechanical devices for charging, drawing, and conveying the billets to the rolls that manual labor around the furnaces is almost eliminated. Very few men will be seen around such furnaces, and such as there are will be seen to be chiefly occupied in carefully watching the furnace and operating levers controlling the charging machine and the roller conveyors which carry the hot billets to the mill.

Practically all the wire rods made in the United States at the present time are produced on one or the other of two types of mills—(1) the Garrett mill or one of its many slight modifications, and (2) the continuous mill. The Garrett mill is of the looping type; but in order to obtain the very high speeds necessary to finish the rod before it has perceptibly cooled and to allow the roughing to be done at as low speed as possible, the mill is split into three or four trains of from two to five stands each, placed end to end as in the bar mills. The feature of chief prominence in this mill is the use of "repeaters" to eliminate the use of a number of highly skilled men. In the bar mills, it will be remembered, the piece is seized by a workman as it issues from each pass, looped around, and entered in the next pass. In the Garrett mill semicircular troughs are arranged leading from one pass to the next, so that the end of the rod is guided by this trough from one stand of rolls to the next and entered in the proper pass without being touched. For technical reasons these trough guides, or "repeaters," can be used on only one side of the mill, so that along one side of such mills at each alternate stand a man will be seen seizing the end of the red-hot rod as it darts out from the rolls, looping the swiftly traveling rod around and entering it into a pass in the next stand. With the rapid reduction of section the length of the rod is constantly increasing, so that loops are formed between each stand, which stretch out along the floor in graceful, glowing lines. These loops must be kept straight, for otherwise the rod will become tangled and a "cobble" will result, necessitating the shutting down of the mill. This is accomplished partly by having the floor slope away from the mill on both sides so that the loop is pulled out straight by its own weight and partly by having "hookers," who are usually boys, straighten out the loops and prevent the rods from being entangled by the use of long rods with a small hook at the end. As there are from three to five loops of different lengths going through the finishing passes at the same time, there is much danger connected with this occupation and great agility is necessary to keep the red-hot rods, which are running at a rate as high as 30 miles an hour from being entangled. These mills run at such speed that when a "cobble" is produced by a twist forming in the rod both sides of the mill become a perfect confusion of red-hot tangled rods before the rolls can be stopped. As the very fast mills finish from three to five rods at a speed of 3,000 feet per minute, a delay of less than a minute suffices to pile up more than a mile of tangled rods, allowing for the shorter length of the rods in the earlier passes.

The continuous-rod mill is entirely different from the Garrett mill. The stands of rolls instead of being placed end to end are placed one behind the other, so that the rod passes in a straight line through all the stands of rolls without being handled during the entire process. Instead of the large number of men around the rolls, as in the Garrett mill, almost none are to be seen in the continuous mill. The only men around such a mill are lever men to start and stop the rolls, control the switch which guides the billet to the proper pass, and to be on hand and act as repair men in case of trouble. These men are located near the rolls in a pulpit, which is usually completely inclosed with heavy close-meshed netting or boiler plate, so that if a cobble occurs they will be protected from the rods which fly in all directions on such occasions. Instances are known where the rods have escaped from the rolls with such a direction and velocity that they became entwined in the girders of the roof before the mill could be stopped. At other times they twist out over the floor and cover the entire space with a network of red-hot iron. So great is the danger from these cobbles that some of the more recently constructed mills are practically inclosed in a cage of heavy wire netting and operated from the outside.

As the red-hot rods issue from the finishing passes of either type of mill they are led by pipe guides to power-driven reels, which automatically wind the long lengths of rod and then drop the finished coil onto a conveyer, which passes through water on the way to the shipping and finishing departments.

AUXILIARY DEPARTMENTS.

With the rod mills the survey of the producing departments may be considered as complete. The tube mills are not considered here, because they are highly specialized and are to be found in comparatively few plants. This does not by any means cover the entire plant, for in the modern steel works very nearly as many men are required in the various auxiliary departments as in the producing departments. The work in these auxiliary departments and the conditions under which such work is done are in no way peculiar to the steel industry and are so generally familiar that very little more than an enumeration of these departments seems to be necessary. The first necessity in practically every department is, of course, steam, which is usually generated in large boiler houses located throughout the plant in the most advantageous positions.

In the best equipped plants these boiler houses are operated with a minimum of labor, mechanical devices being used to bring in the coal, fire the boilers, and remove the ashes. Some of the more recently built boiler plants are constructed with so much space and with such attention to ventilation that the smoke, fumes, and heat which were a characteristic of the old-style boiler house are almost entirely absent. Furthermore, the boiler houses are rapidly being dispensed with through the use of large gas engines, with which, using the waste gases from the blast furnaces, more than enough electric power can be generated to drive all the machinery of the plant. The use of electric power is not yet general, however, and in most of the plants the steam is converted into power in ordinary reciprocating engines, operated either in large groups, as in the blast-furnace and Bessemer departments, or in single units, as in the rolling mills. In no other department can the difference between the construction ideas of 30 years ago and those of to-day be more clearly seen than in the blowing-engine houses. The blowing-engine houses in most of the recently constructed plants are models of cleanliness, safety, and convenience. The house itself is constructed of brick, with a high ventilated roof, good light, and concrete floors as solid as rock and perfectly clean and free from grease. The oiling is largely done automatically, every part of the engine to which a workman may ever go is completely railed, and all moving parts are completely and permanently guarded. All brasses and steel surfaces are polished like mirrors, and dust on any part is unknown. To contrast such equipment with the cramped engine rooms to be found in plants built 30 years ago, where there is scarcely room to pass between the engine and the walls, and where there is almost no protection for moving parts and no safe methods of reaching difficult working positions, is to appreciate the degree to which the economy of proper construction has been realized during this period of evolution.

So tremendous is the consumption of water in a modern steel works that the proximity to an adequate source of supply is one of the prime factors in determining the location of a plant. To pump this great amount of water to the positions where it is needed a very elaborate equipment of pumps is necessary. So nearly perfect and automatic are these pumps in their action that only a few men are needed to tend them. The gas producers, however, which in the modern steel works are used to provide the fuel for the open-hearth and for the reheating furnaces, require a large complement of men. Even the best gas producers, with mechanical stokers and mechanical poking of the fuel in the producers, are not pleasant places in which to work on account of the escaping smoke and gases. They are, however, in complete contrast to the old, poorly constructed producers, from which there is a constant escape of dense smoke and fumes, often heavily laden with poisonous carbon monoxide, into which the gas men must go in performing their duties. Simple exposure to these fumes for only a few minutes is almost suffocating, while to perform any considerable work in the midst of them is exhausting and debilitating in the last degree.

The entire yard is a network of narrow and standard gauge tracks connecting the departments with each other and with the railroad tracks of the main line. Over these tracks run locomotives of all sizes, from the powerful yard engines to the small dinkeys, as well as locomotive cranes. In addition, in order to pile the many kinds of material in the stockyards in an orderly manner and to make it possible to load the material expeditiously and economically, electric overhead cranes of all kinds and sizes from the huge ungainly gantry and bridge cranes to the small overhead transfer cranes are required. Most of these cranes in the modern steel works are equipped with magnets, by which the efficiency of the cranes is greatly increased and the number of men required to help the cranemen is very greatly decreased. To operate all this transportation machinery and keep the yard and tracks clean a very large force of workmen is required. The general conditions as regards danger, exposure to the weather, etc., under which they work are very much the same as in any large railroad yard, except that in the steel plant much of the material handled is hot or in a molten condition.

To maintain the highly complex steel plant and its machinery in proper conditions a large and highly organized mechanical force is required. A part of these men are permanently attached to the various producing departments, so that their general working conditions are very much the same as for the men engaged directly in production. The larger number, however, work in the shops. The principal shops are, of course, the machine shops, but there are also boiler, blacksmith, pipe, pattern, carpenter, paint, tin, electrical, roll, and various special repair shops. Most large steel plants also have a foundry, and in some cases these foundries are very large and produce a merchantable product. These shops, so far as the nature of the work and the general physical conditions are concerned, do not differ in any respect from similar shops operated independently or in connection with other industries. Some of the shops are exceptionally well housed and equipped with the very best provisions for the safety of the workmen and for ventilation and lighting of the shop. In other plants shop conditions are very bad; not only are the buildings badly designed for light and ventilation and the machines without even elementary protection of gears, belts, etc., but the floors are littered with parts and no semblance of order prevails anywhere.

This completes the survey of a complete modern steel works. In making this survey many minor modifications of the types of rolling mills have been ignored as of no importance to those primarily interested in the conditions of labor. The attempt has been made in this description not so much to give a bare outline of the processes as to give an idea of the general nature of the work and at the same time the general physical conditions of speed, temperature, smoke, etc., under which the work is performed, so that in the more detailed discussions of the working conditions which follow, a general picture of the modern plant will be in the reader's mind.

CHAPTER III.

THE WORKMEN.

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GENERAL ORGANIZATION OF LABOR FORCE.

The labor force of the iron and steel industry may be considered as consisting fundamentally of two great groups: (1) The production force, and (2) the mechanical force. This distinction is of the greatest importance because of the essential differences between the two groups. In the first place the general working conditions of the groups are entirely different. The duties of the production force consist largely in operating the furnaces and machines in which iron and steel are manufactured and shaped, and in handling the materials and products. The mechanical force is concerned chiefly with keeping the various appliances and machines in proper working condition and in operating the locomotives for yard transportation and the engines and electric generators which furnish power to the entire plant. The chief difference in working conditions resulting from this distinction of duties is that the work of the production force is necessarily continuous, day and night, and for part of the force also continuous throughout the week, for they must be on duty during every hour that their department is operated. With the exception of the small proportion of the mechanical force who are in charge of the power plants and those who must be present in case of emergencies, the greater part of the work of this group can be done during the day, and their hours of labor can accordingly be easily adjusted to any reasonable schedule. The working time of the mechanical force, however, is likely to be very irregular, with a great deal of overtime and Sunday work, even if the mills are not actually operated on Sunday. The difference in the duties of the two forces also carries with it a difference in the nature and degree of hazard and in the general physical surroundings to which the men are subjected.

The second distinction between the production and the mechanical force lies in the fact that in the employment of the mechanical force the steel industry is to a large extent in direct competition with other industries, so that in no small degree the hours of labor, wages, and other working conditions are determined by conditions outside the steel industry. The skilled and semiskilled steel workers, on the other hand, are so highly specialized that they have practically no openings for employment at reasonable wages outside the steel industry, and the industry is therefore in a peculiar sense responsible for their working conditions.

In order to show the composition of the labor force in a modern highly organized steel plant the following table has been prepared. This table shows for each department the proportion of skilled, semiskilled, and unskilled workmen required to operate the plant. Foremen and bosses are not included in the table:

COMPOSITION OF THE LABOR FORCE OF A LARGE STEEL PLANT, BY DEPARTMENTS

[Foremen, superintendents, and office force are not included.]

Departments.	Total employees.	Number of employees.			Per cent of employees.		
		Skilled.	Semiskilled.	Unskilled.	Skilled.	Semiskilled.	Unskilled.
Production force:							
Blast furnaces	699	52	290	357	7.4	41.5	51.1
Open-hearth furnaces	1,161	421	371	369	36.3	32.0	31.8
Blooming and slabbing mills	477	183	105	189	38.4	22.0	39.6
Structural mills	283	119	51	113	42.0	18.0	39.9
Plate mills	668	284	117	267	42.5	17.5	40.0
Merchant mills	53	28	11	14	52.8	20.8	26.4
Total production force	3,341	1,087	945	1,309	32.5	28.3	39.2
Mechanical force:							
Steam	275	7	180	88	2.5	65.5	32.0
Electric light and power	203	73	117	13	36.0	57.6	6.4
Transportation	396	234	129	33	59.1	32.6	8.3
Shops	1,085	453	483	149	41.8	44.5	13.7
Foundry	83	38	26	19	45.8	31.3	22.9
Shipping and mill yards	376	41	109	226	10.9	29.0	60.1
General yard labor	613	4	17	592	.7	2.8	96.6
Total mechanical force	3,031	850	1,061	1,120	28.0	35.0	37.0
Grand total	6,372	1,937	2,006	2,429	30.4	31.5	38.1

In making this classification those workmen were regarded as "skilled" who were in occupations which demanded a knowledge of some trade or technical process. The "semiskilled" consisted of workmen who acted as helpers to the skilled workmen, and also of those who had been taught to perform some special function. Such functions frequently require considerable dexterity, but they do not demand a special course of training or long experience in the occupation. The "unskilled" workmen consisted largely of "common laborers." Uncertainty frequently arose in classifying the "semiskilled," but the division was made on the basis that all members of this group should earn at least 18 and under 25 cents per hour. As finally classified, all the skilled workmen earned 25 cents or more per hour, the semiskilled 18 and under 25 cents per hour, and the unskilled under 18 cents per hour.

Some consideration should be given to the general characteristics of these various types of workmen before passing on to a discussion of the working force as a whole. Though relatively few in number, the skilled steel workers perform practically all the work which is peculiar to the industry. These skilled steel workers are for the most part native born and are drawn largely from families which either in Europe or in America have been previously identified with the industry, in many cases for several generations. The foreign-born skilled steel workers are chiefly English, Scotch, German, Irish, and Welsh, who learned the trade abroad, but the number of skilled steel workers drawn from Europe in recent years has been very small. The recent report of the Immigration Commission shows that the majority of the English, Irish, Scotch, German, and Welsh combined who are now in the industry came to this country more than 20 years ago, and that less than 15 per cent of them have come within the last five years.[1]

These skilled steel workers are almost without exception well developed physically and far above the average in practical knowledge and intelligence. These physical and mental qualities are in part the result of the vigorous selection that takes place before the man reaches the position of a skilled workman, for he must have mental and physical powers above the average to compete for the higher positions. The nature of the work also tends to produce an unusual physical development and to accustom the workmen to think quickly and accurately in emergencies.

The semiskilled among the production force consist for the most part of workmen who have been taught to perform relatively complex functions, such as the operation of cranes and other mechanical appliances, but who possess little or no general mechanical or metallurgical knowledge. These semiskilled workmen are to a great extent recruited from among the unskilled, although in many cases boys and young men 18 to 20 years of age are being utilized to fill the positions. This class has been developed largely within recent years along with the growth in the use of machinery and electrical power in the industry. The whole tendency of the industry is to greatly increase the proportion of the production force formed by this semiskilled class of workmen. They are displacing both the skilled and the unskilled workmen, though at present the displacement is largest among the unskilled, as the function of most of the machinery recently developed is to perform work formerly done by unskilled labor rather than to eliminate the necessity for skilled employees. The work done, though frequently very complex, is mostly of a routine character, and wherever this is the case it is possible and economical to take either a boy or one of the more intelligent of the unskilled and train him to do the work, even though much time and patience may be demanded for the training.

The unskilled workmen form about half of the production force of the industry as a whole. There is, however, considerable difference between different plants in this respect, depending upon the processes carried on and the mechanical equipment of the plant. In the plant shown in the preceding table the unskilled workmen constituted only 39.2 per cent of the production force, because of the complete mechanical equipment of the plant. Although the unskilled workmen are chiefly recent immigrants from eastern and southern Europe, there are a number of Americans and representatives of the older immigration who, either through old age, accident, or personal unfitness for a higher class of work, form a part of this group. Although, as will be shown more in detail later, there are representatives of nearly every race of immigrants, it is worth noting that the Poles and Slovaks seem to be best qualified for the particular work required in this industry and are given the preference of employment. They are strong, steady, and capable of being trained rapidly. Although the duties of these unskilled workmen are numerous and varied, they consist largely either in handling the materials and products of the different processes or in cleaning up the waste, such as slag and scrap, which accumulates in tremendous quantities in all the departments.

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[1] Reports of the Immigration Commission, vol. 9, p. 282.

Little need be said of the characteristics of the mechanical force, as they differ in no wise from workmen in the mechanical trades generally. The skilled workmen of the mechanical force are the machinists, millwrights, electricians, bricklayers, and locomotive and stationary engineers, who are partly trained in the steel industry and partly recruited from other industries.

The semiskilled workmen are chiefly "handy men" and machine operators, and here, as in the productive departments, this group is being recruited largely from among the unskilled workmen of foreign birth. The unskilled, though usually forming a slightly smaller proportion of the mechanical force than of the production force, are still very numerous and differ in no respect from those in the production force, except that as the productive occupations offer the highest weekly wages and the steadiest employment, the best men tend to secure employment there.

Over all these employees and distinct from them in immediate interests and to a large extent in working conditions are the foremen and bosses. These foremen are of many grades and classes, ranging from the general foreman of a department with the pay and authority of an assistant superintendent to the "straw boss" of a gang of unskilled laborers, who gets little more than the laborers except the honor of being a "boss" and the possible "petty graft" that may be obtained from his gang in return for favors. The last item is sometimes a matter of much importance and is fully discussed in another part of the report (see p. 147). Except for the "straw bosses," the great majority of the foremen are American born, and are recruited almost altogether from the ranks of the skilled workmen. Also it may be noted that many of the skilled workmen who were formerly an integral part of a gang or crew have, in the development of the industry, tended more and more to exercise supervisory functions exclusively. This is true of such occupations as rollers, heaters, shearmen, open-hearth melters, and

Bessemer blowers. In many mills these men have the power of employing and discharging, and are, therefore, to all intents and purposes, foremen, but do not so regard themselves. Nor do the workmen so regard them, but rather as fellow workmen with interests identical with their own. For this reason, as well as because of the traditions of the industry, it is best in this discussion to regard them as a part of the workmen.

RACIAL COMPOSITION OF LABOR FORCE.

The iron and steel industry illustrates in a striking way the extent to which the labor forces of American industries have been recruited from the immigrants who have come to this country in such great numbers. The steel industry offers an unusual field for the employment of raw non-English-speaking immigrants, because of the large amount of heavy manual labor connected with the handling of raw materials and finished products, and much remarkable work has been done in utilizing these immigrants under proper direction to perform comparatively difficult and complex tasks. The employment of immigrants in the steel industry can be best appreciated by comparison with other industries. The table presented below, showing the degree to which the principal American industries have utilized immigrant labor, is taken from the recent reports of the Immigration Commission and relates to the year 1907–8.

NUMBER AND PER CENT OF MALE EMPLOYEES OF EACH NATIVITY, BY PRINCIPAL INDUSTRIES, 1907–8.

[Compiled from Reports of Immigration Commission.]

Industries.	Number of male employees.	Per cent of each specified nativity.			
		Native born of native father.		Native born of foreign father.	Foreign born.
		White.	Negro.		
Mining:					
Coal mining (bituminous)	88,368	21.0	7.6	9.5	61.9
Copper mining and smelting	7,128	21.1	(1)	13.6	65.3
Iron-ore mining	8,281	13.5	29.6	4.3	52.6
Metal manufactures:					
Agricultural implements and vehicles	25,560	20.1	.8	19.8	59.3
Car building and repairing	21,955	27.3	1.8	16.0	54.9
Foundry and machine-shop products	14,888	24.4	.3	19.8	55.5
Iron and steel	**86,069**	**24.2**	**4.7**	**13.4**	**57.7**
Locomotive building	6,815	27.0	.2	24.2	48.6
Sewing machine manufacture	8,536	15.0	.5	26.0	58.5
Textiles:					
Cotton goods	35,893	9.8	(1)	18.1	72.1
Silk goods	4,167	15.9	....	27.6	56.5
Woolen and worsted goods	23,388	13.2	(1)	20.4	66.4
Miscellaneous:					
Boots and shoes	13,184	42.7	.4	23.0	33.9
Cigars and tobacco	19,630	27.8	23.2	10.4	38.6
Clothing	10,616	3.7	.1	13.7	82.5
Furniture	4,295	20.9	.3	19.6	59.1
Glass	11,615	40.7	2.2	16.8	40.3
Leather	11,916	16.5	.4	14.3	68.8
Oil refining	6,083	11.1	.7	21.2	67.0
Paper and wood pulp manufacturing	12,916	40.9	1.4	17.3	40.5
Slaughtering and meat packing	40,080	17.7	7.6	13.4	61.3
Sugar refining	5,826	5.6	.8	8.4	85.3

[1] Less than one-tenth of 1 per cent.

From the above table it will be seen that although the iron and steel industry has a large proportion of foreign-born employees, it is by no means exceptional in this respect. Here, as in practically all the important industries, the foreign born, who are in large part recent immigrants from eastern and southern Europe, constitute a majority of the labor force. The possibility of utilizing this tremendous supply of cheap though untrained labor has contributed greatly to the expansion of the iron and steel industry. The introduction of these unskilled immigrants has had a complex and important effect on the working conditions in the industry.

The following table shows for the industry as a whole the racial distribution existing in 1907–8, as reported by the Immigration Commission. In compiling this table all races having less than 0.5 per cent of the total have been combined and reported as "All others."

RACIAL DISTRIBUTION OF EMPLOYEES IN THE IRON AND STEEL INDUSTRY.

[From Reports of the Immigration Commission, vol. 8, p. 33.]

General nativity and race.	Number.	Per cent distribution.
Native born of native father:		
White	20,801	24.2
Negro	4,066	4.7
Native born of foreign father, by country of birth of father:		
Austria-Hungary	408	.5
England	1,610	1.9
Germany	4,265	5.0
Ireland	3,032	3.5
Scotland	524	.6
Wales	771	.9
All others	932	1.1
Foreign born, by race:		
Croatian	4,003	4.6
English	2,340	2.7
German	4,426	5.1
Greek	567	.7
Irish	2,448	2.8
Italian, North	1,157	1.3
Italian, South	1,793	2.1
Lithuanian	964	1.1
Magyar	4,675	5.4
Polish	7,897	9.2
Roumanian	974	1.1
Russian	1,372	1.6
Scotch	660	.8
Servian	1,046	1.2
Slovak	9,029	10.5
Slovenian	1,359	1.6
Swedish	1,072	1.2
Welsh	1,237	1.4
All others	2,661	3.1
Grand total	86,089	100.0
Total native born of foreign father	11,542	13.4
Total native born	36,400	42.3
Total foreign born	49,680	57.7

The greater number of the second generation of immigrants represented by the "native born of foreign father," it will be noted, were furnished by Germany, Ireland, England, and Wales, their relative importance being indicated by the order given. Among the foreign born these races are still represented by large numbers, but they are entirely overshadowed by the Magyars, Poles, and Slovaks.

Furthermore, the majority of the earlier type of immigrants in the steel industry have been in this country for 15 years or more and have become to all purposes indistinguishable from the second generation of these races. The most important races among the foreign born are, in the order named, the Slovaks, Poles, Magyars, Germans, and Croatians. Taken together the races from southern and eastern Europe constitute 36,351, or 73.2 per cent, of all the foreign born. They alone are equal to the entire number of employees in the industry born in the United States, and exceed the number of white employees born of native parents by 15,550, or 75 per cent.

Furthermore, it may be noted that among the foreign born the Slovaks are four times as numerous as either the English or the Irish, and more than twice as numerous as the Germans. Even the Magyars, who were practically unknown in this country a generation ago, outnumber each of the predominating races of the earlier immigration.

The distribution of employees in the different departments in the industry is particularly interesting. An idea of the differences in the various departments is conveyed by the following table, which shows for a single large steel plant the distribution of employees by departments. This table, of course, is merely illustrative, as it applies only to a single plant, and very wide differences exist between the plants in the different parts of the country. It should be noted also that this table does not include foremen, superintendents, or office force.

COUNTRY OF BIRTH OF EMPLOYEES IN A LARGE STEEL PLANT, BY DEPARTMENTS.

[Only countries from which 200 or more employees were reported in the total for all departments are shown separately, but all are included in the totals, "all foreign born" and "all nationalities."]

NUMBER OF EMPLOYEES.

Departments.	American-born, white.	Foreign born.					All nationalities.
		Austria-Hungary.	England.	Ireland.	Russia.	All foreign born.	
Production force:							
Blast furnaces	130	401	7	58	13	568	699
Open-hearth furnaces	352	411	35	48	221	765	1,161
Blooming and slabbing mills	171	214	27	13	11	306	477
Structural mills	89	65	37	8	64	192	283
Plate mills	266	313	29	12	3	400	668
Merchant mills	5	9	8	1	23	48	53
Total	1,013	1,413	143	140	335	2,279	3,341
Mechanical force:							
Steam	85	134	16	38	39	239	275
Electric light and power	124	31	21	6	3	79	203
Transportation	290	50	11	19	1	93	396
Shops	406	388	89	33	22	676	1,085
Foundry	31	40	2	....	....	51	83
Shipping and mill yards	81	226	12	1	40	293	376
General yard labor	119	287	13	80	42	479	613
Total	1,086	1,156	164	177	147	1,910	3,031
Grand total	2,099	2,569	307	317	482	4,189	6,372

COUNTRY OF BIRTH OF EMPLOYEES IN A LARGE STEEL PLANT, BY DEPARTMENTS—Concluded.

PER CENT FROM EACH COUNTRY.

Departments.	American-born, white.	Foreign born.					All nationalities.
		Austria-Hungary.	England.	Ireland.	Russia.	All foreign born.	
Production force:							
Blast furnaces	18.6	57.4	1.0	8.3	1.9	81.3	100.0
Open-hearth furnaces	30.3	35.4	3.0	4.1	19.0	65.9	100.0
Blooming and slabbing mills	35.8	44.9	5.7	2.7	2.3	64.2	100.0
Structural mills	31.4	23.0	13.1	2.8	22.6	67.8	100.0
Plate mills	39.8	46.9	4.3	1.8	.4	59.9	100.0
Merchant mills	9.4	17.0	15.1	1.9	43.4	90.6	100.0
Total	30.8	42.3	4.3	4.2	10.0	68.2	100.0
Mechanical force:							
Steam	12.7	48.7	5.8	13.8	14.2	86.9	100.0
Electric light and power	61.1	15.3	10.3	3.0	1.5	38.9	100.0
Transportation	73.2	12.6	2.8	4.8	.3	23.5	100.0
Shops	37.4	35.8	8.2	3.0	2.0	62.3	100.0
Foundry	37.3	48.2	2.4	....	....	61.4	100.0
Shipping and mill yards	21.5	60.1	3.2	.3	10.6	77.9	100.0
General yard labor	19.4	46.8	2.1	13.1	6.9	78.1	100.0
Total	35.8	38.1	5.4	5.8	4.8	63.0	100.0
Grand total	32.9	40.3	4.8	5.0	7.6	65.7	100.0

The American-born employees are distributed almost equally between the production force and the mechanical force. The largest numbers of American-born employees are found in the open-hearth department and the shops. Large numbers, however, are also employed in the plate mills and in the transportation department. A much larger proportion of the immigrants from Austria-Hungary and Russia are employed in the production force than in the mechanical force. This is due in large measure to the fact that the proportion of unskilled workmen is somewhat greater in the production force. Approximately 46 per cent of all the Russians are employed in the open-hearth department.

The relative importance of the different races and nationalities in the different departments is indicated more clearly in the second section of the table, which shows separately for each department the per cent of workmen from each specified country.

It will be seen that for the entire working force the white American-born employees constitute approximately one-third of the total number of employees. Roughly speaking, the same proportion holds true in six of the separate departments. In the electric light and power department and in the transportation department the white American-born employees constitute more than 60 per cent of the entire working force. In the remaining departments, however, they constitute less than one-fourth of all employees. The proportions of immigrants from Austria-Hungary and Russia are particularly large in the departments where there is the greatest amount of unskilled work to be done; for instance, for the Austro-Hungarians in the blast furnaces and shipping and mill yards. There is also noticeable in this table a tendency for the employees of a particular race to concentrate in particular departments. For example, the Russian immigrants form a large proportion of the working force in the merchant mills and the structural mills and, in fact, have practically a monopoly of the unskilled positions in these mills. In a similar manner, the Austro-Hungarians dominate the labor force in the shipping and mill yards. The natural tendency of races speaking an alien tongue to concentrate in one particular department or occupation is to some degree counteracted by the policy of many foremen and superintendents to keep as large a mixture of different races in the labor forces under their control as possible. Several superintendents, in interviews with agents of the Bureau, expressed a belief in the wisdom of this policy, both for its productive results and as a protection against the spread of labor organizations. This policy, however, is seldom carried out very rigidly; and in one of the large steel plants in which such a policy was expressed by the superintendent of the open-hearth department, investigation showed that in many of the other departments of the same plant exactly the opposite tendency was in progress. For example, the unskilled laborers in the bricklaying department were with only a few exceptions Italians, the galvanizing department was manned almost entirely by Swedes, practically all of the unskilled blast-furnace workers were Polish, and the finishing department of the rail mill had almost none except Croatians among the unskilled workmen.

It is also of interest in this connection to examine in what degree the representatives of various nationalities occupy the skilled positions. This is brought out clearly in the following table, constructed from the records of the same steel plant which has been alluded to previously and in which the percentages of the employees from each particular country who may be classed as skilled, semiskilled, or unskilled workmen are shown separately. As in the previous tables in this chapter, the designation " skilled " applies to those workmen earning 25 cents or more per hour, " semiskilled " to those earning 18 and under 25 cents, and " unskilled " to those earning under 18 cents per hour.

COUNTRY OF BIRTH OF EMPLOYEES IN A LARGE STEEL PLANT, DISTRIBUTED ACCORDING TO SKILL.

[Superintendents, foremen, and office employees are not included.]

Country of birth.	Total employees.	Number of employees.			Per cent of employees.		
		Skilled.	Semiskilled.	Unskilled.	Skilled.	Semiskilled.	Unskilled.
American born:							
White	2,099	1,106	581	412	52.7	27.7	19.6
Negro	84	34	30	20	40.5	35.7	23.8
Foreign born:							
Austria-Hungary	2,569	218	938	1,413	8.5	36.5	55.0
Canada	13	8	4	1	61.5	30.8	7.7
England	307	180	95	32	58.6	30.9	10.4
Germany	99	51	23	25	51.5	23.2	25.3
Ireland	317	109	83	125	34.4	26.2	39.4
Italy	100	3	29	68	3.0	29.0	68.0
Norway and Sweden	33	23	6	4	69.7	18.2	12.1
Russia	482	59	163	260	12.2	33.8	53.9
Scotland	147	91	30	26	61.9	20.4	17.7
Wales	73	48	13	12	65.8	17.8	16.4
Other countries	49	7	11	31	14.3	22.4	63.3
All foreign born	4,189	797	1,395	1,997	19.0	33.3	47.7
Grand total	6,372	1,937	2,006	2,429	30.4	31.5	38.1

More than one-half of the white American-born employees in this plant are skilled workmen, and from 50 to 70 per cent of the foreign-born employees from Canada, England, Germany, Norway and Sweden, Scotland, and Wales are also skilled. In an entirely different group are the immigrants from Austria-Hungary, Italy, and Russia, less than 15 per cent of each of these nationalities being skilled workmen. Intermediate between these groups are the Negroes and Irish, of whom 40 and 34 per cent, respectively, may be classed as skilled workmen. It is worthy of note that with only one or two exceptions the proportions of the different nationalities who are semiskilled do not vary widely. The fact that such large proportions of the semiskilled have been drawn from all the different nationalities bears out the remark that has been made previously that workmen competent to perform the semiskilled routine tasks and to operate the larger number of machines used in the steel industry can be easily trained and can be recruited from almost any class of workmen. The great difference between the different nationalities consists in whether they possess the qualifications and opportunities for entering the highest grades of employment.

The racial distribution is by no means uniform in all parts of the country, due both to the presence of a large proportion of Negroes in the South and to variations in the location of the different races of the foreign born. In the following table is shown the relative distribution of the races in the three industrial districts used by the Immigration Commission. These districts, it should be noted, differ from those used in the present report. The "East" includes New York, the whole of Pennsylvania, and West Virginia; the "Middle

West" includes Illinois, Indiana, Ohio, and Wisconsin; while the "South" includes Alabama and Maryland.

RACIAL DISTRIBUTION OF EMPLOYEES IN THE IRON AND STEEL INDUSTRY IN THE PRINCIPAL INDUSTRIAL DISTRICTS.

[From Reports of the Immigration Commission, vol. 8, p. 34.]

General nativity and race.	Per cent of each nativity and race in—			
	East district.	Middle West district.	South district.	Total iron and steel industry.
Native born of native father:				
White	24.8	15.1	32.6	24.2
Negro	1.1	.5	39.1	4.7
Native born of foreign father	14.3	13.0	6.9	13.4
Total native born	40.2	28.5	78.5	42.3
Total foreign born	59.8	71.5	21.5	57.7
Principal foreign-born races:				
Croatian	5.3	4.4	(1)	4.6
English	3.0	2.3	1.2	2.7
German	5.0	8.2	1.6	5.1
Italian, South	2.1	.3	4.8	2.1
Magyar	6.6	2.7	.2	5.4
Polish	7.5	24.2	.8	9.2
Slovak	13.1	1.9	1.9	10.5
Slovenian	1.1	5.1	.1	1.6
Swedish	.7	4.4	.7	1.2

[1] Less than one-tenth of 1 per cent.

An examination of the above table reveals a number of striking and important differences between the iron and steel manufacturing districts. Considering first the proportion of native born, it will be seen that in the Middle West they form only 28.5 per cent of the total number of employees, in the East they constitute 40.2 per cent, and in the South 78.5 per cent. The large proportion of native born in the South is due in great measure to the large number of Negroes in that district, who outnumber the native-born employees of white parentage.

The small proportion of native white employees in the Middle West is very striking and of the greatest economic significance, as the conditions represented in that district resemble those in the larger plants in the Pittsburgh district, and much more closely than do the general conditions existing in the East district as a whole. As the large plants represent the type to which all the establishments in the industry are rapidly approaching, careful consideration should be given to the racial distribution in the Middle West district, which best represents the conditions existing in such plants. It will be seen that the American born of American white parents constituted only 15.1 per cent of the whole number of employees in that district, only half as many as the Polish and Slovenians together. Furthermore, the native born of foreign parents are even less numerous, constituting only 13 per cent of the entire number. Among the foreign born the predominating races are as follows, in the order named: Poles, 24.2 per cent; Germans, 8.2 per cent; Slovenians, 5.1 per cent; Croatians and Swedes, 4.4 per cent each. Of all the foreign-born employees in this district more than 60 per cent are of the Slavic races, while the English, Scotch, and Irish, the only ones of these races who spoke English before coming to this country, form a negligible proportion of the entire number of foreign-born employees.

A very different situation from the above, it will be noted, is shown for the East district, where 24.8 per cent, or approximately one-fourth, of the whole number of employees are American born of native white parents. This comparatively large proportion of American white employees is due in large part to the fact that in the more isolated communities of eastern Pennsylvania even the laborers are drawn from the native "Pennsylvania Dutch" and other long-settled stocks.

There is also a striking difference between the East and Middle West districts in the relative importance of the races among the foreign born. In the East district the most important race among the foreign born is the Slovak, with 13.1 per cent, whereas in the Middle West district the Poles are the predominating race, with 24.2 per cent.

In the South an entirely different condition is encountered. Here the Negroes are more than equal in number to the entire number of native-born white employees and are nearly twice as numerous as the total number of foreign-born employees. The only immigrant employees who have to any extent settled in the South are the South Italians, who, it may be noted, are not generally regarded by managers and foremen as efficient and desirable workmen in the steel industry.

The general racial situation in the industry, as well as the racial differences between the districts, may perhaps be made clearer by a restatement in slightly different terms. Considering the industry as a whole, the table shows that more than one out of every two employees was born in Europe and that native-born white workmen whose parents were also born in this country are not found more frequently than once in every group of four employees. In Ohio, Indiana, and Illinois less than one of every six native-born white workmen is the son of parents who were also born in the United States. In the same States are found a great many Poles and other Slavic peoples, equal in number to all the other employees. In the East and Middle West the Negro employees are scarcely noticeable, but in the South two out of every five men in the plants are Negroes.

RACIAL DISPLACEMENTS IN THE PAST THIRTY YEARS.

While it is not the intention of the present report to delve deeply into the history of the steel industry, a cursory examination of the general changes in the labor force that have taken place in the past 30 years throws a great deal of light on present conditions.

No data exist from which a completely satisfactory study of this kind can be made. By a combination of the census data for the years 1880, 1890, and 1900 and the data of the Immigration Commission for 1907–8, however, the larger outlines of the racial movements in the industry may be studied. In the following table these results are summarized:

NUMBER AND PER CENT OF NATIVE AND FOREIGN BORN MALE EMPLOYEES IN THE IRON AND STEEL INDUSTRY AT EACH SPECIFIED PERIOD, 1880 TO 1908.

[Compiled from reports of the Bureau of the Census and of the Immigration Commission.]

Nativity.	1880[1] (Census).	1890[2] (Census).	1900[3] (Census).	1908[4] (Immigration Commission).
Number—				
Native born	72,600	84,831	184,213	36,409
Foreign born	41,537	57,754	103,214	49,680
Total	114,137	142,585	287,427	86,089
Per cent—				
Native born	63.6	59.5	64.1	42.3
Foreign born	36.4	40.5	35.9	57.7

[1] Tenth Census, 1880, Population, pp. 754, 755.
[2] Eleventh Census, 1890, Population, Part II, pp. 358, 359.
[3] Twelfth Census, 1900, Occupations, pp. 12, 13.
[4] Reports of Immigration Commission, vol. 8, p. 33.

The most striking fact revealed by these figures is that during the 20 years, 1880 to 1900, the proportion of native and of foreign born employees did not change materially, but that since 1900 there has apparently been a very large increase in the proportion of foreign born. This change is probably not quite so large as is indicated above, because of the fact that the investigation made by the Immigration Commission did not cover so large a proportion of the plants in the East and South, where the proportion of native born is largest, as in the Pittsburgh and Middle West districts. Allowing, however, for this fact, there seems to be no doubt that a great change has taken place since 1900. This statement is strengthened by the fact that in the East, including Pennsylvania, the figures of the Immigration Commission show that less than one-third of all the foreign born in the establishments investigated have been in the United States more than 10 years, while less than one-fourth of the immigrant employees from eastern and southern Europe have been in the United States more than 10 years. In the South, also, the proof of this change is strong, for while the census of 1900 reported only 9 per cent of all employees in Alabama and Maryland to be foreign born, the Immigration Commission in 1908 found that 21.5 per cent in these States were foreign born. As a matter of fact, therefore, the increase in the proportion of foreign born has been most rapid in this section of the country.

The most remarkable, and for the present purposes the most important change, however, has been that which has taken place in the replacement of the English-speaking and the Teutonic races of immigrants by the Slavic and other non-English-speaking peoples, to whom not only American industries, but also western customs and habits are new and unfamiliar. The change in this respect in the past 30 years is shown in the following table, compiled from the reports of the Bureau of the Census and the Immigration Commission, giving the percentage of the foreign born drawn from each of the important European countries for 1880, 1890, and 1908. The data for 1900 unfortunately are not available, because the Twelfth Census in reporting the country of birth departed from the custom of previous censuses and combined the native and foreign born instead of reporting the country of birth of the latter separately.

PER CENT OF FOREIGN-BORN EMPLOYEES REPORTED FROM EACH COUNTRY OF BIRTH.

[Compiled from reports of the Bureau of the Census and of the Immigration Commission.]

Country of birth.	Per cent of foreign born from each country.		
	1880[1]	1890[2]	1908[3]
English-speaking countries	70.0	56.5	14.0
British America	5.3	4.2	.5
England, Scotland, and Wales	24.4	24.0	8.6
Ireland	40.3	28.3	4.9
Non-English-speaking countries	30.0	43.5	86.0
Austria-Hungary	(4)	4.2	56.0
Germany	22.4	23.5	8.9
Italy	(4)	.8	5.9
Russia	(4)	1.0	5.5
Sweden and Norway	2.5	5.7	2.4
Other countries	5.1	8.3	7.3

[1] Tenth Census, 1880, Population, pp. 754, 755.
[2] Eleventh Census, 1890, Population, Part II, pp. 488, 489.
[3] Reports of Immigration Commission, vol. 8, p. 33.
[4] Included with "Other countries."

It will be seen that within the past 30 years the character of the foreign-born portion of the labor force has entirely changed. In place of the 70 per cent of foreign born coming from English-speaking countries in 1880, there were in 1908 only 14 per cent. This change is particularly noteworthy in the decline in the proportion of the Irish, from 40.3 per cent in 1880 to 4.9 per cent in 1908. These peoples of western Europe have been replaced largely by the natives of Austria-Hungary, who in 1880 were too few in number to be reported separately, and who by 1908 had increased so as to form a majority (56 per cent) of the foreign-born employees. The decline in the proportion of Germans and of the English, Scotch, and Welsh, it should be noted, has taken place entirely since 1890.

The same facts are clearly illustrated by a different method in the following table showing the number of years which the representatives of the principal foreign-born races have been in the United States:

PER CENT OF FOREIGN-BORN MALE EMPLOYEES IN THE UNITED STATES EACH SPECIFIED NUMBER OF YEARS, BY RACE.

[By years in the United States is meant years since first arrival in the United States. No deduction is made for time spent abroad. This table includes only races with 1,000 or more males reporting. The total, however, is for all foreign born. Compiled from Reports of Immigration Commission, vol. 8, p. 25, and vol. 9, p. 282.]

Races.	Number reporting complete data.	Per cent in United States each specified number of years.				
		Under 5.	5 to 9.	10 to 14.	15 to 19.	20 or over.
Croatian	3,985	61.5	29.1	4.9	3.3	1.2
English	2,328	12.5	7.4	7.3	12.7	60.1
German	4,405	17.8	14.4	4.1	12.9	50.8
Irish	2,432	8.1	9.5	7.8	12.1	62.5
Italian, North	1,153	42.7	37.9	10.3	5.8	3.3
Italian, South	1,787	51.5	30.3	8.6	6.2	3.4
Magyar	4,643	57.5	29.5	6.4	4.7	1.8
Polish	7,880	43.6	31.0	8.0	8.8	8.7
Russian	1,368	65.7	24.1	5.2	2.9	2.3
Servian	1,042	62.7	30.2	5.2	1.7	.3
Slovak	8,993	39.6	32.8	11.9	8.1	7.6
Slovenian	1,358	46.9	35.7	9.0	6.5	1.9
Swedish	1,072	13.0	20.4	9.2	20.0	37.4
Welsh	1,230	3.9	3.7	31.5	15.4	45.4
All others	5,788	54.7	20.0	5.2	6.0	14.1
Total	49,464	41.1	25.3	8.2	8.1	17.4

It will be seen that more than two-thirds of the foreign born from western and northern Europe, the English, Germans, Irish, Swedes, and Welsh, have been in this country 10 years or more, while the majority of the workmen from eastern and southern Europe have been here less than 5 years. Furthermore, the percentages in each group indicate roughly the order in which the different races came: First, the English and Irish, more than 60 per cent of whom have been in America 20 years or more; second, the Germans, Welsh, and Swedes, in the order named; and finally the Poles and Slovaks, followed by the other races of the recent immigration.

ABILITY TO SPEAK ENGLISH.

The net result of the changes that have been taking place in recent years has been to produce a labor force a very large proportion of whom neither speak nor understand English. The reports of the Immigration Commission, covering 86,089 employees, show that in 1908 nearly one-fourth of the labor force in the industry were unable to speak English. This proportion, of course, varied largely in the different parts of the country. In the following table, compiled from the Immigration Commission's report, the situation as regards the ability to speak English is shown for the country as a whole and for the separate districts reported upon.

NUMBER OF EMPLOYEES AND PER CENT WHO DO NOT SPEAK ENGLISH.

[Compiled from Reports of the Immigration Commission, vol. 9, pp. 281, 349, 350, 367, 603, 619, 640, 653.]

Locality.	Total number of employees.	Employees who do not speak English.	
		Number.	Per cent of total.
East	65,711	15,651	23.8
Middle West	12,053	3,749	31.1
South	8,325	914	11.0
Total	86,089	20,314	23.6

The largest proportion of English-speaking employees is to be found in the South, where only a small number of immigrants have as yet entered the industry. In that section approximately only one out of every nine men was unable to speak English. The largest proportion unable to speak English, one out of every three employees, was in the Middle West. In the East generally, however, the proportion of non-English-speaking employees was high, there being about one man in every four unable to speak English.

Since the Immigration Commission's investigation covered a number of small and isolated plants in which the proportion of immigrants is small, the figures do not show the situation existing in the large plants. From reports available for a number of the larger plants in Allegheny County, Pa., for March, 1907, it appears that of the 23,337 employees included 7,479, or 32 per cent, were unable to speak English. Similarly, from the reports of one of the large plants in the Chicago district for January, 1907, it appears that of the 8,368 employees, 56.3 per cent were unable to speak English. While it is possible that the company in its own reports puts a somewhat stricter interpretation on the term "English speaking" than did the Immigration Commission, it is certain that at that period the company named was employing an unusually large proportion of non-English-speaking workmen. Since that time there has been a considerable increase in the proportion of English-speaking employees, as shown by the following figures:

PROPORTION OF EMPLOYEES UNABLE TO SPEAK ENGLISH, IN A LARGE STEEL PLANT OF THE MIDDLE WEST, 1907 TO 1911.

Year.	Total number of employees.	Per cent of employees unable to speak English.
Jan. 1, 1907	8,368	56.3
Jan. 1, 1908	8,136	47.5
Jan. 1, 1909	6,330	37.1
Jan. 1, 1910	8,928	43.8
Jan. 1, 1911	6,364	32.9

While a part of this improvement would have come naturally through the acquirement of the language by the employees during the course of five years, it is known that this company about 1908 took definite steps to improve the conditions in this respect. During the year of depression, 1908, the non-English-speaking workmen were laid off in large numbers, so that by January 1, 1909, the proportion of non-English speaking had dropped from 47.5 per cent to 37.1, a decrease of nearly 22 per cent. When brisk activity was resumed in the fall of 1909, it was necessary to take on a large number of non-English-speaking workmen to recruit the force, but, though the mills were running with a larger force than in 1907, there were only 43.8 per cent of this class in place of the 56.3 per cent of non-English-speaking employees in 1907. In 1911, although a larger part of the plant was operating than in 1909, there were only 32.9 per cent of employees unable to speak English, as against 37.1 per cent in 1909. These figures may be compared with those for one of the largest plants in the Pittsburgh district, where the proportion of English-speaking employees is much higher. This table is particularly interesting, because the departments are shown separately. It should be noted, however, that the percentage of blast-furnace employees who speak English is abnormally high and is due largely to local conditions.

ABILITY TO SPEAK ENGLISH OF EMPLOYEES IN A LARGE PLANT IN THE PITTSBURGH DISTRICT.

Departments.	Number of employees.			Per cent of employees.	
	Speak English.	Do not speak English.	Total.	Speak English.	Do not speak English.
Production force:					
Blast furnaces	494	74	568	87.0	13.0
Open-hearth furnaces	527	238	765	68.9	31.1
Blooming and slabbing mills	222	84	306	72.5	27.5
Structural mills	165	27	192	85.9	14.1
Plate mills	330	70	400	82.5	17.5
Merchant mills	47	1	48	97.9	2.1
Total	1,785	494	2,279	78.3	21.7
Mechanical force:					
Steam	206	33	239	86.2	13.8
Electric light and power	75	4	79	94.9	5.1
Transportation	89	4	93	95.7	4.3
Shops	622	54	676	92.0	8.0
Foundry	36	15	51	70.6	29.4
Shipping and mill yards	178	115	293	60.8	39.2
General yard labor	317	162	479	66.2	33.8
Total	1,523	387	1,910	79.7	20.3
Grand total	3,308	881	4,189	79.0	21.0

The employment of a large proportion of men unable to speak English has, as is pointed out in Volume IV of this report, Accidents and Accident Prevention, a great bearing on the occurrence of accidents. This was realized by the company whose comparative statistics for 1907 to 1911 have been given above, and it was on this ground that it undertook to reduce the proportion of its employees who were unable to speak English. This was done entirely by a process of selection rather than by education. Although the results for the company will probably be much the same in the end, selection is a slower and socially a less desirable method of securing an English-speaking labor force than education, for in the process of "weeding out" the non-English-speaking a large number of recent immigrants are suddenly thrown on the labor market and at the same time there is no increase in English-speaking population.

In addition to its effect in increasing the rate and seriousness of accidents, the presence of so large a body of non-English-speaking people ignorant of American customs and ideals has done much to perpetuate a species of petty extortion on the part of foremen and bosses generally. Finally, it renders any collective action on the part of the employees looking toward the betterment of conditions very difficult.

AGE DISTRIBUTION.

The labor force of the iron and steel industry is made up largely of men in the prime of life—between 20 and 44 years of age. There is very little work in which child labor can be used profitably, and many of the companies have taken a decided stand against the employment of any children below the age of 16. There is at least one large company which does not employ anyone under 18 years of age, except for work in the office. There is also comparatively little work in the producing departments which can be done by men who are past the age at which they are capable of strenuous physical labor. Many companies reserve such positions as those of watchman and policeman and various semiclerical positions for their employees who have become disqualified for filling the more arduous positions. The entire number of these, however, is so small that they do not greatly affect the labor force as a whole. It is true, nevertheless, that there are a number of men who have retained their vigor to a phenomenal degree and who are still filling very arduous positions long after the age when men ordinarily give up hard physical labor.

There are many factors which combine to give the industry at the present time a high proportion of men between the ages of 25 and 44. In the first place, the labor force in the steel industry has within the last few years been largely recruited from the ranks of the recent immigrants. Practically all of these immigrants come to

America while they are comparatively young men, and most of them have been in the steel industry such a short time that they are still less than 45 years of age.

Furthermore, there is a comparatively rigid selection of only the younger and more vigorous men at the time of their employment. This is particularly true in the case of companies which have established either a pension system or a voluntary benefit plan. It is inevitable in such cases that the greatest care will be taken in selecting those who will be good "risks" and who will have served the company for several years before the time for the necessary retirement comes.

There is a great difference as regards age distribution between the various races and nationalities. This is clearly shown in the following table, compiled from the reports of the Immigration Commission, which shows, by race and nativity, the per cent of employees in each age group:

PER CENT OF MALE EMPLOYEES WITHIN EACH AGE GROUP, BY GENERAL NATIVITY AND RACE.

[From Reports of Immigration Commission, vol. 8, p. 158. This table includes only races with 1,000 or more males reporting. The totals, however, are for all races.]

General nativity and race.	Number reporting complete data.	Per cent within each specified age group.						
		14 to 19 years.	20 to 24 years.	25 to 29 years.	30 to 34 years.	35 to 44 years.	45 to 54 years.	55 years and over.
Native born of native father:								
White	20,801	11.6	20.4	19.1	15.1	19.4	9.7	4.7
Negro	4,066	6.2	22.7	22.1	14.5	19.7	11.6	3.1
Native born of foreign father, by country of birth of father:								
England	1,610	17.0	22.9	18.1	12.4	17.8	8.2	3.7
Germany	4,265	15.9	20.0	16.9	13.6	19.1	11.3	3.0
Ireland	3,032	12.6	18.3	15.1	14.9	23.3	12.2	3.6
Foreign born, by race:								
Croatian	4,003	5.4	34.4	25.4	15.0	16.5	3.0	.3
English	2,340	2.9	8.7	12.5	15.5	30.1	19.1	11.2
German	4,426	2.2	9.4	14.2	13.1	26.6	20.9	13.6
Irish	2,448	.7	5.3	12.2	12.5	32.9	22.3	14.1
Italian, North	1,157	6.6	28.7	23.2	18.8	17.0	4.6	1.2
Italian, South	1,793	6.8	26.8	23.1	16.2	19.0	6.7	1.3
Magyar	4,675	4.4	20.9	24.6	20.2	23.5	5.5	.9
Polish	7,897	2.3	23.4	28.0	17.8	20.7	6.7	1.2
Russian	1,372	3.9	27.1	28.6	20.0	17.7	2.5	.2
Servian	1,046	4.0	36.4	27.6	14.3	14.8	2.7	.1
Slovak	9,029	5.0	23.2	23.7	18.4	23.0	6.1	.6
Slovenian	1,359	4.4	25.0	25.9	19.4	20.2	4.5	.6
Swedish	1,072	.8	12.4	16.3	16.2	31.7	17.3	5.2
Welsh	1,237	4.7	8.2	9.3	14.6	32.8	19.7	10.7
Grand total	86,089	7.7	21.1	20.9	15.8	21.2	9.5	3.8
Total native born of foreign father	11,542	17.6	21.1	16.5	13.0	18.9	9.8	3.0
Total native born	36,409	12.9	20.9	18.6	14.4	19.3	10.0	4.0
Total foreign born	49,680	3.9	21.2	22.6	16.9	22.6	9.2	3.7

The different races may be placed in three groups on the basis of age distribution. Group 1 includes all the native born without regard to parentage and is characterized by a regular and gradual decrease in the age groups above 20 years.[1] Group 2 includes the foreign born of the earlier immigration, the English, Germans, Irish, Swedes, and Welsh. This group is characterized by very small percentages in the groups under 30 years, and by very large percentages in the groups 35 years and over. Group 3, which includes the more recent immigrants, Croatians, Italians, Magyars, etc., is characterized by the fact that almost all the employees of these races are 20 and under 44 years of age.

A probable explanation of these characteristic differences is as follows: The Americans and other races in group 1 enter the industry at a comparatively early age (under 25 years), but as they grow older leave the industry for other pursuits or are removed by death and disability. In group 2 the situation is entirely different. Practically no foreign-born English, Germans, etc., are entering the industry, and very few have done so recently, but those who are in the industry tend to remain permanently, as indicated by the large proportions in the older age groups, and do not leave it for other lines of work. The more recent immigrants who make up group 3 are practically all grown men, but few of them appear in the older age groups, because they are not generally employed if above 45 years of age and few of them have been in the country long enough to have grown old in the service.

In order to show the age distribution of the employees in the different departments of the industry a tabulation has been made of the complete labor force of one of the largest steel plants in the country. The two tables which follow show for each of the principal departments and for each class of officials and clerks the proportions who are in each age group.

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[1] It should be noted that above 35 years the groups are 10 years, while below 35 they are 5 years. The 10-year groups represent a decrease unless the percentage in them is twice as large as that in the preceding 5-year group. For example, in the native born of native father, white, the 35 to 44 year group would need over 30.2 per cent in order to represent an increase over the 30 to 34 year group, which has 15.1 per cent.

AGE DISTRIBUTION OF EMPLOYEES IN A LARGE STEEL PLANT, BY DEPARTMENTS.

NUMBER OF EMPLOYEES.

Departments.	Total.	Employees in each age group.										
		Under 16.	16 and under 18.	18 and under 20.	20 and under 25.	25 and under 30.	30 and under 35.	35 and under 40.	40 and under 45.	45 and under 50.	50 and under 60.	60 and over.
Production force:												
Blast furnaces	699	......	1	29	163	156	120	113	56	33	25	3
Open-hearth furnaces	[1]1,161	......	53	69	208	227	197	179	114	71	40	2
Blooming and slabbing mills	477	......	17	18	82	80	58	67	58	42	43	12
Structural mills	283	......	6	14	35	53	46	46	38	22	19	4
Plate mills	[2]668	1	10	29	107	139	131	100	76	39	28	6
Merchant mills	53	......	......	......	6	12	11	10	6	3	3	2
Total	[3]3,341	1	87	159	601	667	563	515	348	210	158	29
Mechanical force:												
Steam	[1]275	......	......	4	32	50	43	54	17	31	30	13
Electric light and power	203	1	4	6	47	61	37	22	12	3	7	3
Transportation	[1]396	......	......	10	100	91	58	72	28	16	16	4
Shops	[1]1,085	1	16	49	222	207	168	144	104	70	83	20
Foundry	83	......	2	3	14	11	15	14	5	8	7	4
Shipping and mill yards	376	......	17	25	69	81	41	63	37	29	10	4
General yard labor	[1]613	2	19	36	102	95	83	86	58	57	49	25
Total	[4]3,031	4	58	133	586	596	445	455	261	214	202	73
Grand total	[5]6,372	5	145	292	1,187	1,263	1,008	970	609	424	360	102

PER CENT OF EMPLOYEES IN EACH AGE GROUP.

Production force	[3]100.0	([6])	2.6	4.8	18.0	20.0	16.9	15.4	10.4	6.3	4.7	0.9
Mechanical force	[4]100.0	0.1	1.9	4.4	19.4	19.7	14.7	15.0	8.6	7.1	6.7	2.4
Total	[5]100.0	.1	2.3	4.6	18.7	19.8	15.8	15.2	9.6	6.7	5.7	1.6

[1] Including 1, age not reported.
[2] Including 2, ages not reported.
[3] Including 3, ages not reported.
[4] Including 4, ages not reported.
[5] Including 7, ages not reported.
[6] Less than one-tenth of 1 per cent.

AGE DISTRIBUTION OF OFFICIALS AND CLERICAL FORCE IN A LARGE STEEL PLANT.

Occupations.	Total.	Employees in each age group.										
		Under 16.	16 and under 18.	18 and under 20.	20 and under 25.	25 and under 30.	30 and under 35.	35 and under 40.	40 and under 45.	45 and under 50.	50 and under 60.	60 and over.
Superintendents, assistant superintendents, etc	46	......	......	......	......	......	5	17	13	7	3	1
Foremen	232	......	......	......	11	24	38	58	40	32	22	7
Recorders, weighmasters, etc	[1]116	......	3	12	36	25	17	6	6	1	8	1
Clerks, stenographers, etc	[1]353	1	8	38	82	66	47	40	26	14	23	7
Messengers	76	32	38	4	......	1	......	1	......	......	......	......
Chemist's helpers	115	......	7	17	34	23	17	6	5	3	2	1
Police	62	......	......	......	1	3	9	10	9	12	13	5
Janitors, storemen, etc	34	......	......	......	4	1	4	6	8	3	5	3
Total	[2]1,034	33	56	71	168	143	137	144	107	72	76	25

[1] Including 1, age not reported.
[2] Including 2, ages not reported.

The most important comparison is between the employees of the production force and of the mechanical force. The striking fact in this comparison is that there is a much larger proportion of older men in the mechanical force than in the production force. For example, 16.2 per cent of the mechanical force are 45 years or more of age, while only 11.9 per cent of the production force are as old as 45 years. There is, furthermore, three times as large a proportion of men 60 years of age and over in the mechanical force as in the production force. In making these comparisons it should be noted that the police, janitors, and other occupations in which there is an unusually large proportion of older men, have been purposely transferred from the mechanical force to appear with the officials and the clerical force.

EXPERIENCE OF IMMIGRANTS BEFORE ENTERING THE STEEL INDUSTRY.

Comment has already been made on the fact that the immigrants who are now forming a very large part of the labor force of the industry were drawn chiefly from the farms of Europe and had no industrial experience before they came to this country. The significance of this fact as regards its influence on accident occurrence is fully discussed in Volume IV of the present series. Immigration of this character has also had a great effect on the hours of labor and general working conditions in the steel industry. These workmen, ignorant not only of the conditions existing in other American industries, but even of the conditions in the industries of Europe, are unlikely to protest against or even to question any conditions that may be imposed upon them. The influence of this element upon various working conditions is discussed in later chapters of this volume.

In the table which follows are presented the facts as to the occupation before coming to the United States of the foreign-born employees in the iron and steel industry. These statistics are compiled from the reports of the Immigration Commission.

PER CENT OF FOREIGN-BORN MALE EMPLOYEES EMPLOYED IN EACH SPECIFIED CLASS OF INDUSTRY BEFORE COMING TO THE UNITED STATES, BY RACE.

[Compiled from Reports of the Immigration Commission, vol. 8, p. 41, and vol. 9, p. 287.]

	Number reporting complete data.	Per cent who were employed in—			
		Manufacture of iron and steel.	Other manufacturing.	Farming or farm labor.	Other occupations.
All foreign-born employees	40,659	8.6	2.7	64.4	24.3
Earlier immigration	8,400	27.4	6.0	31.7	34.9
Recent immigration	32,259	3.8	1.9	72.8	21.5
Earlier immigration, by race:					
English	1,301	48.1	6.8	3.2	41.8
German	2,919	16.9	7.5	40.1	35.6
Irish	1,686	9.8	4.0	60.6	25.6
Scotch	403	42.7	5.2	6.0	46.2
Swedish	906	21.1	6.8	34.1	38.0
Welsh	747	72.0	3.1	1.7	23.1
Other races	438	26.9	5.9	18.5	48.6
Recent immigration, by race:					
Croatian	3,132	1.5	1.4	86.0	11.3
Italian, North	1,013	2.2	1.4	57.1	39.4
Italian, South	1,518	2.2	1.4	59.0	37.4
Lithuanian	907	3.2	1.4	84.0	11.3
Magyar	4,097	5.9	1.3	69.6	23.2
Polish	7,167	5.0	2.4	71.8	20.8
Roumanian	901	3.1	.7	80.6	15.7
Russian	1,280	3.0	2.3	69.1	25.7
Servian	700	2.1	.9	79.4	27.6
Slovak	8,330	2.9	1.8	75.7	19.7
Slovenian	1,230	3.2	2.8	73.6	21.5
Other races	1,984	6.0	2.7	60.5	30.8

A large number, more than one-fourth of the earlier immigrant employees, came to this country already trained in the industry through their experience in the steel works of Europe, and 6 per cent had been trained in some other manufacturing industry. The contrast with the recent immigrants is striking. Only 3.8 per cent of these employees were in any way connected with the iron and steel industry in Europe, and only 1.9 per cent were engaged in any other manufacture. Nearly three-fourths of these men, 72.8 per cent, were drawn from farm work and therefore not only are unacquainted with any manufacturing industry but are unfamiliar with all the complexities of modern city life.

A study of the conditions as regards the individual races makes the contrast even more striking. Of the English 48.1 per cent were trained in the industry before coming to the United States; 42.7 per cent of the Scotch, and 72 per cent of the Welsh were similarly trained and, consequently, entered the industry here familiar with all its dangers and working conditions. A much smaller proportion of the Irish than of any other of the older races were familiar with the industry, but there is a great difference between the adaptability of the Irish, understanding English and otherwise quick to learn, and that of the non-English-speaking races from southern and eastern Europe. Of these races the Slovaks with 8,330 persons have only

2.9 per cent with previous experience in the industry, the Polish and Magyars have 5 and 5.9 per cent, respectively, and the Croatians only 1.5 per cent.

CONJUGAL CONDITION OF EMPLOYEES AND SIZE OF FAMILY.

The following table compiled from the reports of the Immigration Commission shows for the male employees 20 years of age and over the proportion in each conjugal condition:

PER CENT OF MALE EMPLOYEES 20 YEARS OF AGE AND OVER IN EACH CONJUGAL CONDITION, BY GENERAL NATIVITY AND RACE.

[From Reports of the Immigration Commission, vol. 8, p. 211. This table includes only races with 500 or more males reporting. The totals, however, are for all races.]

General nativity and race	Number reporting complete data.	Per cent who are—		
		Single.	Married.	Widowed.
Native born of native father:				
White	14,357	28.0	69.6	2.5
Negro	709	28.3	66.4	5.2
Native born of foreign father, by country of birth of father:				
England	1,126	36.4	61.7	1.9
Germany	2,757	32.4	64.8	2.8
Ireland	2,263	41.8	54.8	3.4
Wales	607	35.1	62.9	2.0
Foreign born, by race:				
Croatian	3,291	43.5	55.5	1.0
English	1,894	20.0	75.9	4.1
German	3,223	16.8	79.5	3.7
Irish	2,090	24.0	70.0	5.9
Italian, South	1,248	37.9	61.3	.8
Magyar	4,119	26.0	72.7	1.3
Polish	4,757	38.0	61.2	.8
Roumanian	835	48.3	50.5	1.2
Russian	948	35.5	63.6	.8
Scotch	517	24.2	71.8	4.1
Servian	903	45.6	53.3	1.1
Slovak	8,199	22.7	76.3	1.0
Slovenian	702	32.1	67.2	.7
Grand total	60,332	30.4	67.4	2.2
Total native born of foreign father	7,685	37.6	59.8	2.7
Total native born	22,751	31.2	66.2	2.6
Total foreign born	37,581	30.0	68.2	1.9

This table shows that approximately two-thirds of all the employees 20 years of age and over were married. As compared with the native born the foreign-born employees show a slightly larger percentage of married, but of these a large proportion have left their wives and families abroad and support them by sending them whatever money they can save from their wages. The following table shows the percentage of foreign-born husbands who reported having left their wives abroad.

PER CENT OF FOREIGN-BORN HUSBANDS WHO REPORT WIFE IN THE UNITED STATES AND PER CENT WHO REPORT WIFE ABROAD, BY RACE OF HUSBAND.

[From Reports of the Immigration Commission, vol. 8, p. 213. This table includes only races with 500 or more husbands reporting. The total, however, is for all foreign born.]

Race of husband.	Number reporting complete data.	Per cent reporting wife— In United States.	Per cent reporting wife— Abroad.
Croatian	1,784	37.9	62.1
English	1,395	97.9	2.1
German	2,506	91.0	9.0
Irish	1,444	98.6	1.4
Italian, North	528	58.5	41.5
Italian, South	753	60.6	39.4
Magyar	2,883	56.5	43.5
Polish	2,857	74.4	25.6
Russian	596	45.3	54.7
Slovak	6,172	63.1	36.9
Welsh	760	98.7	1.3
Total	25,062	69.3	30.7

The families of the workmen in the iron and steel industry are comparatively large, due principally to the very large families of the more recent immigrants. The following table shows the average size of the family in a large number of households investigated by the Immigration Commission. The percentage of families having each specified number of persons is also shown.

PER CENT OF HOUSEHOLDS OF EACH SPECIFIED NUMBER OF PERSONS, BY GENERAL NATIVITY AND RACE OF HEAD OF HOUSEHOLD.

[From Reports of the Immigration Commission, vol. 8, p. 113. This table includes only races with 100 or more households reporting. The totals, however, are for all races.]

General nativity and race of head of household.	Total number of households.	Average number persons per household.	Per cent of households of each specified number of persons. 1	2	3	4	5	6	7	8	9	10 and over.
Native born of native father:												
White	108	4.88	......	12.0	21.3	19.4	13.0	7.4	10.2	10.2	4.6	1.9
Negro	121	3.44	1.7	38.0	26.4	10.7	9.1	7.4	3.3	.8	1.7	.[illegible]
Foreign born:												
Bulgarian	139	6.19	.7	9.4	13.7	15.1	16.5	6.5	7.2	9.4	6.5	15.1
Croatian	189	8.85	......	3.7	5.8	5.3	8.5	10.6	7.9	12.7	7.9	37.6
German	107	7.11	......	10.3	7.5	12.1	15.9	12.1	6.5	6.5	9.3	19.6
Italian, South	373	5.26	......	11.8	15.5	19.0	15.5	12.1	9.7	4.3	5.1	7.0
Magyar	260	6.77	......	6.5	13.5	10.4	13.5	9.6	10.4	6.2	8.5	21.5
Polish	360	5.78	......	8.1	12.2	12.5	13.6	21.1	13.6	4.7	5.6	8.6
Slovak	186	5.84	......	6.5	13.4	18.3	12.4	11.8	9.1	14.0	6.5	8.1
Grand total	2,456	6.33	.1	9.4	13.0	13.6	13.1	11.8	9.9	7.4	6.5	15.2
Total native born of foreign father	83	4.83	......	10.8	22.9	21.7	12.0	8.4	9.6	8.4	2.4	3.6
Total native born	812	4.31	.6	21.8	23.7	16.7	11.2	7.7	7.4	6.1	2.9	1.9
Total foreign born	2,144	6.63	(1)	7.6	11.4	13.2	13.3	12.5	10.2	7.6	7.0	17.2

[1] Less than one-tenth of 1 per cent.

In order to show the relation between the conjugal condition and the earning power of the workmen a tabulation has been made of the employees in one of the largest steel plants in the country. In this tabulation the employees are divided into three groups: The skilled, those who earn 25 cents or more per hour; the semiskilled, who earn 18 and under 25; and the unskilled, who earn less than 18 cents per hour. This table includes only the actual workmen, foremen, superintendents, and office employees being excluded.

OCCUPATIONAL STATUS OF EMPLOYEES IN A LARGE STEEL PLANT ACCORDING TO NATIVITY AND CONJUGAL CONDITION.

[Superintendents, foremen, and office employees are not included.]

Nativity and conjugal condition.	Total employees.	Number of employees.			Per cent of employees.		
		Skilled.	Semiskilled.	Unskilled.	Skilled.	Semiskilled.	Unskilled.
American:							
Married	1,171	820	269	82	70.02	22.97	7.00
Single	968	292	333	343	30.17	34.40	35.43
Widowed	44	28	9	7	63.64	20.45	15.91
Total	2,183	1,140	611	432	52.22	27.99	19.79
Foreign born—western and northern Europeans:							
Married	710	414	169	127	58.31	23.80	17.89
Single	241	79	82	80	32.78	34.02	33.19
Widowed	51	24	6	21	47.06	11.76	41.18
Total	1,002	517	257	228	51.60	25.65	22.75
Foreign born—eastern and southern Europeans:							
Married	2,379	249	898	1,232	10.47	37.75	51.79
Single	774	29	231	514	3.75	29.84	66.41
Widowed	34	2	9	23	5.88	26.47	67.65
Total	3,187	280	1,138	1,769	8.79	35.71	55.51
All employees:							
Married	4,260	1,483	1,336	1,441	34.81	31.36	33.83
Single	1,983	400	646	937	20.17	32.58	47.25
Widowed	129	54	24	51	41.86	18.60	39.53
Total	6,372	1,937	2,006	2,429	30.40	31.48	38.12

Of the married employees, 34.8 per cent are skilled employees, and consequently earn 25 cents or more per hour, which for the majority of occupations in this plant is equivalent to a daily wage of $3 or more. The semiskilled and unskilled groups are of approximately the same size, each including practically one-third of the total number of married employees. Among the single workmen, however, the skilled group includes only 20.2 per cent, while the unskilled group includes 47.3 per cent. The number of widowed employees is too small to be of any significance.

The differences, however, are most marked when the native born are studied separately from the foreign born. Of the married American-born workmen 70 per cent are skilled, while of the married foreign-born workmen from eastern and southern Europe only

10.5 per cent can be classed as skilled. There is, however, a very much less difference between the American workmen and the foreign born from western and northern Europe. Of the married employees of this class 58.3 per cent can be classed as skilled workmen. In every case the percentage of married employees who are skilled workmen is very much larger than in the case of the single employees. This, of course, rises chiefly out of the greater age of the married employees. The proportion of married Americans and of the foreign born from western Europe who are unskilled is relatively small. With regard to the Americans, it may be remarked that practically all of them are white.

CHAPTER IV.

THE RELATIONS OF EMPLOYERS AND WORKMEN.

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INTRODUCTION.

Within 20 years practically all the conditions affecting the relations of employers and workmen in the iron and steel industry have been altered. These changes may be discussed under four principal heads: (1) Changes in the processes and technical methods of manufacture; (2) changes in the racial composition of the working force; (3) changes in the ownership and organization of the industry; (4) changes in the strength and character of labor organizations. The first two of these subjects are thoroughly discussed in Chapters III and XIII, and it is necessary only to point out their bearing on the question under consideration.

In 1890, while all the important methods of producing steel were in use, the development of mechanical methods of handling materials and of regulating processes had hardly begun. The iron and steel industry therefore required a very much larger proportion of highly skilled and specially trained men than at the present time. The supply of such workmen was limited and could not be increased at will as is the case with unskilled labor, which can readily be recruited either from other industries or from Europe by slightly increasing the rate of wages. Such a situation assured the skilled workmen a considerable degree of independence and of control over their working conditions. The introduction of mechanical processes has to a large degree displaced these men either with unskilled laborers or with semiskilled workmen who can be recruited by the thousand whenever it is necessary. Similarly, although in 1890 there was a large proportion of foreign-born employees in the industry, they were principally English, Irish, Welsh, and Germans, and were therefore largely familiar either with the iron and steel industry or with some other industry organized along similar lines. At present more than half of the working force of the industry is drawn from the farms of eastern and southern Europe, and is therefore accustomed to the position of tenant or farm laborer and unacquainted with the wage system of industry. Apart from the unwillingness of the English-speaking workmen to associate with these immigrant employees, the working force is at present divided into two groups which are unable to communicate except by signs or through an interpreter.

In 1890, although there were a number of companies with comparatively large capital, there had been only three consolidations of any moment in the industry,[1] and the typical establishment was of small size and was owned by an individual or a partnership rather than by a corporation. The skilled workmen, on the other hand, were largely banded together in one strong organization, the Amalgamated Association of Iron and Steel Workers, and so successful had it been in extending its influence and membership that many of the manufacturers expected that it would within a short time reach such a position that it would have to be dealt with by the manufacturers acting through some form of organization.[2] It was suggested at this time that to avoid the losses from strikes and other labor disturbances, voluntary arbitration should be submitted to and some form of profit sharing generally introduced which would tend to identify more closely the interests of the skilled workmen with those of the manufacturers.[3]

The consolidation of manufacturing interests has been achieved to a degree which in 1890 was not believed to be possible, but instead of the strong organizations of workmen expected the end of 20 years sees the employees not only without strong unions, but completely unorganized in all except two minor branches of the industry, and even there the union is extremely weak. Not only is there no arbitration of questions involving wages and working conditions between two strongly organized parties to the dispute, but it is generally insisted that the employees shall accept whatever wages are offered without dispute or argument. In many companies no committees are received even to present the case of unorganized men, the management dealing only with the individual workman. Instead of the identification of the interests of the employers and employed by a wide extension of profit sharing, only two companies have made any efforts in this direction, and these so recently that no effects in the direction hoped for can be perceived.

The consolidation of the manufacturing interests has been progressing steadily since 1890 and has now reached the point where a single corporation with a total outstanding capitalization, including stocks and bonds, of one and a half billion dollars, controls one-half the industry,[4] and a half dozen other large corporations with a total outstanding capitalization of three hundred and sixty millions owns more than one-third of the productive capacity of the other half of the industry. Two of these large "independent" companies—the Cambria Steel Co. and the Pennsylvania Steel Co.—are controlled by the Pennsylvania Railroad Co., which owns the majority of their stocks.[1] There are, of course, a large number of comparatively small companies, but most of these are interested either in the operation of small blast furnaces or puddling mills and small rolling mills for wrought iron. The steel industry proper, therefore, is largely in the hands of a small number of large and powerful corporations. In addition to this centralized ownership, the steel manufacturers are held together by the social forces of such organizations as the American Iron and Steel Association and the American Iron and Steel Institute. While these organizations have special purposes quite far removed from the promotion of common action in labor disputes, the result of the close association of the most prominent men in the industry is conducive to a common attitude toward labor and labor organizations.

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[1] Prior to 1890 the Illinois Steel Co., the Southern Iron Co., and the Tennessee Coal, Iron & Railroad Co. had been formed by consolidation of existing plants. Carnegie Bros. & Co. and Carnegie, Phipps & Co. had grown by extension of their activities and absorption of other concerns, but did not represent any definite consolidation.

[2] See addresses and discussion before British Iron and Steel Institute at the American meeting of 1890. Journal of the Iron and Steel Institute, 1890.

[3] Address of Hon. A. S. Hewitt, Journal of the Iron and Steel Institute, 1890, pp. 344–368.

[4] Report of Commissioner of Corporations on the Steel Industry, part 1, 1911, p. xxiii.

All of these large companies and corporations, with two exceptions, insist upon dealing with their workmen as individuals. Furthermore, the two large corporations, which employ union men, have them only in their puddling mills and small rolling mills, which branches constitute only a small part of their business.

In contrast to this great aggregation of power on the part of the manufacturers, the two unions of iron and steel workers had in 1911 a total membership of less than 6,000 of the 275,000 men employed in the manufacturing plants of the industry. In no branch of the industry, except perhaps in puddling, do these unions include a majority of the skilled workmen. There is only one open-hearth steel plant in the United States for which a wage scale is signed by organized workmen and no Bessemer steel plant. Not only is there a lack of any formal organization in these departments, but, as will be shown later, there are strong forces working to increase the state of disorganization in which the workmen in this industry have been practically since the early nineties.

LABOR ORGANIZATIONS PRIOR TO FORMATION OF THE STEEL CORPORATION.

Without entering into a detailed history of unionism in the steel industry, a brief outline of the most important events and an analysis of the policies of the manufacturers and of organized labor will serve best to indicate how the present situation has developed.

Prior to 1876 there had been a number of unions of varying importance made up largely of men in particular occupations. The earliest and strongest of these unions was the Sons of Vulcan, made up of the puddlers and their helpers. This union was openly organized in 1861, and by 1873 had 83 lodges, with a total membership of 3,331. There were various local and partially developed unions of the heaters and roll hands, most of which were organized during the sixties. By 1873 many of these local lodges had been brought together to form the Associated Brotherhood of Iron and Steel Heaters, Rollers, and Roughers, which in 1874 had a membership of 700 in 28 lodges. This union did not admit the lower paid men of the rolling crews, and these, together with some rollers and roughers, were organized in a separate union known as the Iron and Steel Roll Hands of the United States, which was organized about 1870, and which in 1873 had 15 lodges and 473 members. Each of these three unions might have a lodge in the same mill with the members working side by side under the same roof. This situation caused a great deal of jealousy and much internal strife. It was early seen that the position of organized labor would be greatly strengthened by some form of consolidation, and definite attempts were made to bring the three unions together as early as 1873. The movement was slow in developing, but in 1875 a joint convention of the three unions was held in Pittsburgh, and after much discussion a definite consolidation was formed as the National Amalgamated Association of Iron and Steel Workers. The Sons of Vulcan, the puddlers' union, being by far the strongest of the constituent unions, dominated the appointment of officers, appointing members of its own union to the principal offices. In 1877 the first annual convention was held at Columbus, Ohio, with 77 delegates in attendance. There were at that time 111 active lodges, with a membership of 3,755, and a balance of only $802.96 in the treasury. During the next five years the association grew so rapidly that in 1882 there were 197 lodges and 16,000 members.

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[1] Pennsylvania Railroad Co., Annual Report, 1911.

In 1882 there was a general strike of the organized workmen in the puddling and iron rolling mills for increased wages. The strike started from the demand on the part of the puddlers for an increase in the price paid for puddling from $4.50 per ton as a base rate to $6 a ton. The men in the rolling mills demanded an increase from 68.75 cents to 75 cents per ton for bar mill rolling. The men in the sheet rolling mill joined the strikers and likewise demanded a similar advance in their wages. The strike lasted from June 1 to September 20, and resulted in a complete loss for the union, the men going back at the old scale and accepting all conditions after being out on strike for nearly four months. The effects of this strike are seen in the loss of membership of the union, which dropped from 16,000 in 1882 to 11,800 in 1883. As a result of this and other fruitless labor disputes, the chief of which was in connection with the Edgar Thompson Works, the membership by 1885 had fallen to 5,702, the lowest point which it reached between its establishment and the end of the year 1910.

During the period 1882 to 1886 the Knights of Labor, which at that time was at its greatest strength, organized several locals in the steel works of Allegheny County, taking into the union all classes of labor, both skilled and unskilled. This organization was peculiarly fitted to deal with the situation in the steel mills, since it was not organized on strict trade lines, and, as a policy, had from the beginning made special scales of wages to meet peculiar conditions. The general policy of the Amalgamated Association, on the other hand, had from the beginning been very exclusive, so that the union embraced only the more highly skilled men in a comparatively limited part of the rapidly developing steel industry, and the organization of lodges in the steel mills was in large part merely incidental to the development and strengthening of the organization in what may be called the iron branch of the industry. At no time in the history of the Amalgamated Association was any attempt made to work out a logical scheme for dealing with the highly complex situation in the steel mills, nor was even a separate branch organized for unifying the many lodges which developed in connection with the large steel plants. The scales for the steel plants were left almost entirely to the individual local lodge, and as a result of this policy the widest discrepancies existed between the scales for different steel plants. Much emphasis is placed upon this feature, because there is no doubt that the chaotic condition of the wage scales of different steel plants and the lack of any consistent policy with reference either to the hours of labor or to other working conditions were in part responsible for the opposition of the steel manufacturers to the Amalgamated Association.

The presence of both the Amalgamated Association and the Knights of Labor in the steel branch of the industry greatly weakened the position of both organizations. In some cases both of these unions had lodges in the same mill, and jurisdictional disputes between these two organizations were frequent and annoying. Nevertheless, the supply of skilled men was small in comparison to the demands of the industry, and in the period of comparative industrial peace, from 1885 to 1889, local lodges of the Amalgamated Association were organized in many of the steel mills both in Allegheny County and in the Middle West. The union grew steadily, and in 1889 the total membership had reached 16,117 members. The industry and its mechanical equipment were developing at a rate that has hardly been equaled in any other industry, and it was impossible to make the constant readjustments in wages and general working conditions which the new manufacturing methods demanded without considerable opposition from the members of the union. The constant friction which arose in readjusting working conditions proved a source of great irritation to the manufacturers, and there is no question that they were impatient at all times to be rid of the obstacles which the union placed in the way of their making changes in the working conditions of their plants in any way and at any time they saw fit.

This was a period, moreover, of the greatest rivalry between the steel manufacturers. Every effort was bent to the establishment of new records of production, and both men and machines were driven to the utmost in order to produce new records which would startle the manufacturing world. The Amalgamated Association had definitely attempted to carry over into the rapidly developing steel branch of the industry many of the restrictions on output which had prevented overspeeding in the iron branch of the industry. Any sort of restriction on output was naturally distasteful to steel manufacturers, and the forms of restriction used by the unions were in many cases illogical and not applicable to the new methods of production which had been developed. The profits of the industry during this period were very large, and while this situation led the manufacturers to accept almost any conditions under pressure, on the other hand, the results which many of the manufacturers were getting served only to increase the envy and emulation of the other manufacturers. As a result of the working of these various forces and motives, the steel manufacturers, particularly in Allegheny County, constantly attempted to rid themselves of the presence of organized labor in their mills. Most of these attempts did not result in serious trouble, because usually the lodges were very strong and the attempts to break their power were abandoned before any considerable dispute had been caused.

In 1889, however, the firm of Carnegie, Phipps & Co. proposed a new agreement for their Homestead plant, which brought about a definite issue as to whether the union was to continue in that plant. The conditions which they proposed definitely demanded the abandonment of all the essential features of the union policy. Both production and prices were favorable during that year, and there was apparently no good reason in the general industrial situation to call for any considerable change in the working conditions. The new agreement proposed, among other things, the reduction of the wages of all union men in the plant, and also imposed two other conditions which the union considered especially inimical to its interests. The first and most important was a demand that the new scale should be signed by each workman individually. This was practically a demand that the general principle of collective bargaining, upon which all labor organization must necessarily be based, should be abandoned or at least greatly weakened. The second demand was that the new agreement should terminate on January 1 instead of on July 1, as had been the case with all previous agreements. This provision was opposed chiefly because it made the scale for this particular mill end at an entirely different time of the year from the scales in the other branches of industry, so that in case of difficulty the workmen in other branches of the industry would be bound by their contracts not to go out on a sympathetic strike in order to support their fellow workmen. A second reason was to be found in the fact that a strike can be much more easily and successfully conducted during the summer months than in midwinter.

This scale was, therefore, refused as soon as it was offered, and the workmen at the Homestead steel works immediately went out on strike. The strike was short-lived and resulted in a victory for the workmen, since they went back to work after signing an agreement which practically continued all the conditions which had been in effect during previous years. A new wage scale, however, was signed for the Homestead steel works which was based upon the sliding-scale principle, to which both the workmen and the manufacturers were favorable. The success of the union in this strike served to still further increase the membership, so that in 1891 the union reached the high-water mark of its membership, with a total of 24,068 members, organized in 290 lodges. The financial resources had increased even more rapidly, and at the convention in June, 1891, the union had a balance of $146,000 in its treasury, or double the balance shown for 1889, while the number of members had increased 50 per cent in the same time.

In the summer of 1892, while the union was in this prosperous condition, the most important struggle in its history was precipitated by the expiration of the old scale for the Homestead steel works which had been signed in 1889, to continue for three years. Carnegie Bros. & Co., as the firm was known at this time, offered a new scale of wages, involving reductions in a number of positions, with the new base rate for the sliding scale lower than that of the previous scale. It was again provided that the scale should terminate on January 1 instead of in July, which, as has been seen, was a bone of contention between the steel manufacturers and the Amalgamated Association. While the demand was not made, as it had been in 1889, that the men should sign the scale individually, the workmen regarded the new proposition, nevertheless, as a direct challenge to contest the right of the union to maintain its position in the Homestead steel works.

The general events of the Homestead strike are so well known and have been so frequently described that they need not be discussed in this connection. It is important only to understand that the settlement of the strike in the Homestead steel works and in the other plants in which the workmen struck in sympathy was disastrous for the union. The workmen, at the end of the five months' struggle, not only lost all that they had demanded and returned to work after signing individual contracts as nonunion men, but the organization was so weakened that it was unable to hold its membership even in the iron mills of the Pittsburgh district, which had formerly been thoroughly organized. The membership fell from 20,975 in 1892 to 10,000 in 1894, at which figure it remained practically unchanged until 1900. One by one the steel mills and most of the iron mills of the Pittsburgh district succeeded in weakening and finally dislodging the union.

From 1892 to 1901 the position of the Amalgamated Association was almost entirely defensive, in marked contrast to the strongly aggressive policy which had formerly characterized it. It still had great strength in the iron mills of the Western Bar Iron Association and in the sheet, tin, and hoop mills throughout the country, as well as considerable strength in the steel mills of Ohio and Illinois.

LABOR ORGANIZATIONS UNDER THE STEEL CORPORATION, 1902 TO 1911.

In 1900 the Amalgamated Association was spurred to action by the consolidation of a number of large companies forming the constituent corporations from which the United States Steel Corporation was later built. As a result of this new activity it succeeded in increasing its membership and reviving something of the old spirit of aggression. The revival of this aggressive spirit was shown at the convention of that year by the passage of the following amendment to its constitution:

> Should one mill in a combine or trust have a difficulty, all mills in said combine or trust shall cease work until such grievance is settled.[1]

The purpose of this amendment was to promote unity of action on the part of the members of the union, and the lack of discussion in the convention indicates that at the time of its passage little consideration was given to the probable effects of this resolution. The idea which underlaid the passage of the amendment was to oppose the consolidated strength of all branches of the Amalgamated Association to the consolidated strength of the large corporations, such as the American Tin Plate Co., the American Sheet Steel Co., and the Federal Steel Co. The force of this provision in the constitution was greatly weakened and rendered difficult of application by the fact that the United States Steel Corporation from the start insisted upon and constantly maintained the position that as far as operating conditions were concerned each of the subsidiary companies was an independent unit, and consequently must settle its own affairs absolutely without reference to the conditions in the other companies. If it had been seen at the time what complications would arise from the enforcement of this resolution it is unquestionable that it would at least have been given more thorough consideration in the convention of the association.

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[1] Constitution Amalgamated Association of Iron, Steel, and Tin Workers, art. 17, sec. 22.

Before considering the results which grew out of the passage of this resolution it is necessary to consider briefly the policy of the United States Steel Corporation, which had been organized during 1901. The attitude of the Steel Corporation toward organized labor during 1901 is exhibited in the minutes of its executive committee which form the basis of the present discussion. These minutes are printed as a part of the hearings of the congressional committee on investigation of the United States Steel Corporation.[1] All the minutes, however, relating to the attitude of the corporation toward labor conditions or labor organizations are reprinted in full in Appendix D to this volume, page 497.

The newly formed Steel Corporation, almost immediately after its formation, gave the question of its attitude toward trade-unions the most careful and thorough consideration. The first meeting of the executive committee of the Steel Corporation was held on April 9, and its attention was, during the first few meetings, necessarily largely occupied with matters connected with the financing of the corporation and with the relations of the various subsidiary companies to each other. On April 20, however, the question of the attitude of the corporation toward trade-unions and toward its employees generally was brought up for the first time. In practically every meeting of the executive committee for the next few months this question was a subject of discussion.

The first point on which a decision was reached by the United States Steel Corporation was that the strongest insistence should be placed on the idea that the corporation as a whole would not deal in any way directly with labor organizations, but that each subsidiary company was responsible for the conduct of all negotiations and settlements with regard to labor conditions.[2] While this position was prominently placed before the public, the president of the organization and the executive committee were in constant communication with the subsidiary companies, endeavoring to become thoroughly conversant with every aspect of the labor situation, and to be able to meet whatever developments might arise.[1]

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[1] Hearings Before the Committee on Investigation of United States Steel Corporation; Report of Farquhar J. MacRae to chairman of Special Committee to Investigate Violations of the Antitrust Act of 1890 and Other Acts, Part II, pp. 3741–4318.

[2] "Mr. Edenborn thinks it expedient to inform the newspapers and the public generally that the United States Steel Corporation is not the one employer, but that the individual companies are distinct and separate for themselves; that the labor troubles of any one company must be settled by the particular company as an individual company, and a strike in one must be settled independently of any other company." (Minutes, executive committee, Apr. 20, 1901.)

"The president is of the opinion that when the presidents [of the subsidiary companies] get back they ought to be in a position to know exactly what our policy is and be able to take the matter into their own hands.

"There was considerable discussion on this subject, and finally the chairman stated as follows:

"The first question to consider is, What, if any, answer should be made if the association sends representatives to this company direct? So far as we understand, this committee is in favor of saying to such representatives that this is a question that pertains to the business of the local company, and we do not undertake to instruct or interfere with the business of the subsidiary companies. This corporation is but a stockholder.

Upon the basis of the information received the most diverse views were expressed by the members of the executive committee. The general position which developed from the discussion, however, was that the union was so strong that it must undoubtedly be dealt with, at least until the corporation was more firmly established and its securities were more widely distributed.[2] At the same time it was unanimously decided that the union should not be allowed to extend its membership and power into any of the mills that were not then recognized as union mills. This position is most clearly expressed in the minutes of the meeting of June 17, when the discussion had been brought to an issue by the realization that the Amalgamated Association would present its demands within a few days. At this meeting the whole situation was gone over thoroughly, and a vote was taken on the question of whether or not the members of the executive committee would approve of making a decisive fight if a general strike should be ordered. On this question the majority of the committee voted affirmatively, one did not vote, while another voted in the negative.[3] The other question as to the general attitude of the corporation toward organized labor was brought to a definite issue by the presentation of a resolution by Mr. Steele, which was as follows:

> That we are unalterably opposed to any extension of union labor, and advise subsidiary companies to take firm position when these

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and intends only to advise, the same as any stockholder." (Minutes, executive committee, June 17, 1901.)

"The president stated that the question to decide is whether representatives should be sent and if so, just how they should be instructed and who should be sent. The chairman stated that it should be clearly understood that the United States Steel Corporation has nothing whatever to do with it; that the representatives of the three subsidiary companies are not to state that they are acting in concert, or even by consultation, with any of the officials of the United States Steel Corporation." (Minutes, executive committee, July 6, 1901.)

[1] "The president reports that he has had a talk with the presidents of the subsidiary companies with reference to the attitude of organized labor, and has learned from reports of the meeting of the association in Milwaukee that it has been decided to make no material changes in the scale.

"The president stated that he has recommended that the presidents of the constituent companies sign the scale for mills where the association is established, providing the scales were reasonable; that he has recommended to them that the present condition of things be maintained at all their mills." (Minutes, executive committee, June 3, 1901.)

"Upon motion, the president was instructed to advise Mr. Arms [vice president of the American Tin Plate Co.] to write a letter in accordance with copy handed to the president. [This letter was dictated by the chairman and approved by the committee.] It having been learned that Mr. Arms (had) left the office for the day, the president stated he would see him the next day, hand him the copy, and give him such instructions as the committee desired." (Minutes, executive committee, July 2, 1901.)

[2] Minutes, executive committee, Apr. 20, 1901.

[3] Idem, June 17, 1901.

> questions come up and say that they are not going to recognize it, that is, any extension of unions in mills where they do not now exist; that great care should be used to prevent trouble, and that they promptly report and confer with this corporation.[1]

The vote on this question was apparently unanimous and the president, Mr. C. M. Schwab, was instructed to convey this resolution to the presidents of the subsidiary companies.[1] These instructions were put into effect by the subsidiary companies, as is shown by the following extract from the minutes of the executive committee on July 8, about three weeks after the passage of the resolution:

> The president reported that the superintendent of the Wellsville sheet mill down on the Ohio River had discharged 12 men who were endeavoring to institute a lodge. Later in the meeting the chairman read an Associated Press dispatch referring to this and stating that the men were discharged on Saturday last, and that Shaffer had announced that the men would have to be reinstated before any conference could be had.
>
> The president stated that he then had no positive information as to the time these men were discharged, but it later developed that it was done prior to Saturday, the 6th instant. The president thinks it was done under old instructions.

The third feature of the policy of the corporation toward the organization of labor in the mills which had not previously been recognized is brought out in the minutes of July 2, at the time when the question of signing the scale for three mills, which had been considered nonunion in the preceding year, was under consideration. No definite decision was reached at this time, but the chairman, whose decision carried the greatest weight, stated "that he would be willing to concede two mills as union mills, to sign the scale for the McKeesport mill and to keep it shut down."[2]

This policy of signing the scale under pressure for certain mills and then virtually annulling the agreement by shutting down the mill had been frequently practiced by other companies prior to the formation of the corporation, and was a source of the greatest irritation to the Amalgamated Association. It made it impossible for them to see clearly just what had been gained as the result of the negotiations and, furthermore, such action was most unsatisfactory to the workmen in those mills for which the scale was signed when the mills were immediately after shut down. The officers of the union were frequently charged with bad faith by the union men on the ground that in order to gain a technical point in having a large number of additional mills signed for in any one year they were willing to make a deal with the company by which certain of the mills should not be operated. This policy of shutting down mills for which the scale had been signed was in line with a plan of action which the union officials strongly accused the corporation of pursuing. This plan consisted essentially in diverting as large a proportion of orders as possible to nonunion mills instead of distributing the work evenly in proportion to the capacity of the plants. The result of this was naturally to create dissatisfaction on the part of the union men, for while their scale of wages might be more advantageous, if the plants in which they were working did not operate steadily, their earnings for the year would be very much lower than those of the nonunion men who had the advantage of steady work.

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[1] Minutes executive committee, June 17, 1901. [2] Idem, July 2, 1901.

The attitude of the United States Steel Corporation at this time, as shown in the minutes of its executive committee, may be briefly summed up as follows: Although several members of the executive committee were desirous of ridding the corporation of organized labor, the committee as a whole believed it best to temporize with the situation, the only aggressive measures taken being to prevent the organization of additional lodges in mills which had not up to that time been recognized as union mills. With the exception of one member of the committee, none of the members was desirous of having a decisive contest with organized labor at this time, and were willing to concede a great deal in order to postpone labor troubles. The Steel Corporation, while publicly insisting upon its unwillingness to control the actions and policy of the subsidiary companies, was at the same time giving the presidents of the subsidiary companies the most definite instructions, and, furthermore, the representatives who were to meet and discuss matters with the Amalgamated Association were selected and specially instructed by the executive committee of the corporation from its New York office.[1]

Having thus explained the policy and attitude of the two parties to the controversy it is possible to understand the developments of the strike of 1901. On one side was the Amalgamated Association, encouraged by its recent gains in membership and realizing that, if they were ever to enter into a contest with the Steel Corporation, action should be taken immediately, before the organization of the corporation was completed and while its policies were still unformed.[2] The association was at least partially justified in its belief that such a contest was inevitable, because of the aggressive policy of the corporation in denying its nonunion men the right to organize.[3]

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[1] Minutes, executive committee, Apr. 20, June 17, and July 6, 1901. See footnotes on pp. 117 and 118.

[2] Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6297.

[3] Resolution of executive committee, June 17, 1901, and action at Wellsville mill, pp. 118 and 119.

On the other side of the contest was the Steel Corporation, anxious to avoid trouble during its critical year, and at the same time determined to prevent the extension of union labor in its mills.

The situation in 1901, out of which the strike immediately arose, was as follows: The American Tin Plate Co. had for a number of years signed the scale for all but one of its plants, with regard to which there was a special contract situation. The American Sheet Steel Co., however, had never signed the scale for more than three-fourths of its mills. In 1901 a statement in the Journal of the Amalgamated Association, page 6046, shows that the situation of the union in connection with the American Sheet Steel Co. in that year was as follows:

NUMBER OF UNION AND OF NONUNION MILLS OF THE AMERICAN SHEET STEEL CO. AT WORK AND IDLE IN 1901, AND NUMBER OF STANDS OF ROLLS IN SUCH MILLS.

	Number of plants.	Stands of rolls.
Union mills at work	11	67
Union mills idle	9	33
Nonunion mills at work	7	68
Nonunion mills idle		
Total	27	168

Of the union mills which were reported idle in that year four were dismantled during the years 1901 and 1902, on account of their inefficiency and poor condition, and one other mill was dismantled in 1904. The nonunion plants, on the other hand, included some of the most recently built and most efficient plants of the American Sheet Steel Co. During the previous year an attempt had been made to have the scale signed for all mills of the American Sheet Steel Co., but it was immediately abandoned. That little was expected in this direction is indicated by the tone of the president's report, in which he spoke as follows: "The chief object aimed at was the signing of the scale for all mills. Our first attempt in this direction was met by the statement that it was not a matter for discussion and could not even be considered. Their position was rendered impregnable by the disparity between the union and nonunion mills."[1]

This policy of opposing the extension of the union to additional mills had been taken by the American Sheet Steel Co., as an independent organization, before the formation of the United States Steel Corporation. It was believed that this position might be considerably modified through the influence of the corporation, and in accordance with the resolution of the association passed at the Cleveland conference in 1901 it was decided to make a determined demand that the scale should be signed in that year for all the mills of this company. The first conference with regard to the scale was held with the American Tin Plate Co., on June 21, 1901. The scale was very quickly agreed upon and the proposition was immediately made by the association that it should apply to all mills of the American Tin Plate Co., including Monessen, which had not previously been signed for. To this proposition the strongest objection was made on the ground that it was not fair to compel the American Tin Plate Co. to sign for all its mills since the American Sheet Steel Co. had previously signed the scale for less than two-thirds of its mills. This action, it was insisted, would put the American Tin Plate Co. at a decided disadvantage in the eyes of the corporation. The association representatives replied that they expected to secure from the American Sheet Steel Co. contracts for all their mills. The scale was signed by the American Tin Plate Co. and the Amalgamated Association for all mills except Monessen, as it had been in previous years, possibly, however, with the oral agreement that if the American Sheet Steel Co. should sign the scale for all its mills Monessen should be added to the list of union mills for the American Tin Plate Co.[1] On June 26 the Amalgamated Association met with the representatives of the American Sheet Steel Co., and when they put forward a demand that the scale should be signed for all mills they were met with a counter proposition that the American Sheet Steel Co. would not sign the scale for two of the mills which had been recognized as union mills the previous year. Neither of these mills had been operated during the past year, but no concessions from this position could be obtained by the representatives of the Amalgamated Association, although an additional conference was held on the 29th. On July 1, 1901, a strike was ordered against the American Sheet Steel Co. and the American Steel Hoop Co. The strike was ordered by the following circular:

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1901, p. 6046.

OFFICE OF NATIONAL LODGE,
Pittsburgh, Pa., July 1, 1901.

To the officers and members of the A. A. of I. S. and T. W.

BRETHREN: Your sheet conference met representatives of the American Sheet Steel Co. and tried to arrange a scale for the mills which they operate. After two days of consultation we adjourned and met again at their call on Saturady, June 29, when they made a proposition to sign the scale for Ætna-Standard, Canal Dover, Hyde Park, Midland, Piqua, Carnegie, Struthers, Canton, New Philadelphia, Cambridge, Dennison, Falcon, and Dresden, thus refusing not only to sign for all their mills, but classing the Old Meadow and Saltsburg among the nonunion mills, in spite of the fact that these mills were signed for the last year and were working, or supposed to be working, under our scale; but the trust, by refraining from operating these mills, forced our people into agreeing to leave the association. This was manifestly acting in bad faith, and your committee believed it was in duty bound to have included in the organized mills at least these two mills. What the trust did with them it has tried to delude your committee into doing with those of you who work in the mills for which they are willing to sign. They refuse to recognize or sign for McKeesport,[1] which is an organized mill with about 400 members in the lodge. Their action demonstrates that they think we have not the right to organize even while they themselves are organized to control competition and are so closely banded together that they believe labor must submit to their arbitrary, inconsistent, and unjust dictation, forgetting that competition is the life of commercial trade and that capital is secure and prosperous only when labor is well paid and contented.

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1902, pp. 6295 and 6328.

We are united for protection and to secure fair conditions and reasonable wages. They are united to obtain profits and to make more money from the efforts of the workers. We ask them to put all their labor on an equality by permitting it to be organized as they are. Yet they arbitrarily deny us this privilege which they enjoy. "Oh, consistency, thou art a jewel."

Brethren, we must resist, only because we can not endure. I ask all men of honor and principle to leave the mills of the American Sheet Steel Co. and refuse to work until they recognize and admit our right to organize if we desire.

To the independent mills now operating I appeal for aid. Assess yourselves liberally, unsparingly, and send your contributions at once to the national office so that at the beginning we may fight the trust with the only weapon they can use—money. We have right, justice, public sympathy, and, I trust, Divine approval; let us also have money. Upon you we are leaning; we trust you and are sure you will not fail. Give our cause to the newspapers of your town or city. Let the people of America know what they may expect from the trusts. Warn all workers to keep away from these mills: Apollo works, Vandergrift, Pa.; Cambridge works, Cambridge, Ohio; Canton works, Canton, Ohio; Chartiers works, Carnegie, Pa.; Chester works, Chester, W. Va.; Corning works, Hammond, Ind.; Dennison works, Dennison, Ohio; Dresden works, Dresden, Ohio; Falcon works, Niles, Ohio; Hyde Park works, Hyde Park, Pa.; Kirkpatrick works, Leechburg, Pa.; Saltsburg works, Saltsburg, Pa.; Laufman works, Paulton, Pa.; Midland works, Muncie, Ind.; New Philadelphia works, New Philadelphia, Pa.; Old Meadow works, Scottdale, Pa.; Piqua works, Piqua, Ohio; Reeves works, Canal Dover, Ohio; Scottdale works, Scottdale, Pa.; Struthers works, Struthers, Ohio; Ætna-Standard works, Bridgeport, Ohio; Wellsville works, Wellsville, Ohio; W. D. Wood works, McKeesport, Pa.

These are on strike or nonunion until the scales are signed for them. No man can work for them without staining his reputation and leaving dishonor and shame as the heritage of his children.

We have had peace for years, not because we have had fair treatment, but because we have suffered and endured to win them to just and fair business methods; but they would not be won. Let us now resist until they are compelled to acknowledge that men who are conservative in order to be just can suffer to overthrow oppression.

All our members are hereby notified that there are no open mills among those operated by the American Sheet Steel Co. and American Steel Hoop Co., and all lodges will notify those of their members who may be working in such mills that their future course must be determined by the lodges on receipt of this communication. The subjoined mills are those of the American Steel Hoop

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[1] Scale was not sgined for McKeesport in 1901. It was then classed as nonunion. (See Journal of Proceedings, National Lodge Amalgamated Association, 1901, p. 6046.)

Co. which are on strike or nonunion: Upper and lower mills in Youngstown, the mills in Girard, Greenville, Warren, Pomeroy, Lindsay & McCutcheon, Painters, Monessen, Solar, Pittsburgh, Duncansville.

Yours, fraternally,

T. J. SHAFFER.[1]

At the same time the following letter was sent to the American Tin Plate Co.:

PITTSBURGH, PA., *July 1, 1901.*

Mr. WARNER ARMES,
Vice President American Tin Plate Co.

DEAR SIR: I am compelled by circumstances and the duties of my position to call your attention to complications which have arisen since we agreed to the scale rates for 1901 and 1902.

Our constitution, Article XIX, section 35, page 43, states: "Should one mill in a combine or trust have a difficulty, all mills in said combine or trust shall cease work until such grievance is settled."

Inasmuch as the American Sheet Steel and the American Steel Hoop Cos. have refused to sign the scale for their mills, and the American Tin Plate Co. is a part of the United States Steel Co., of which the above-named companies are also constituents, I hereby inform you that if this difficulty or agreement is not adjusted on or before Monday, July 8, it will be my very, very unpleasant duty to call from their work all of your workmen who are members of the Amalgamated Association.

Hoping something will occur to prevent this, and assuring you that this is done with great reluctance, I remain,

Yours, truly, T. J. SHAFFER, *President.*[2]

This letter amounted practically to announcing that the members of the Amalgamated Association would be forced to break their contract with the American Tin Plate Co., which had signed only a week before. A reply to the letter of President Shaffer, quoted above, clearly states the position of the American Tin Plate Co.

JULY 3, 1901.

T. J. SHAFFER,
President Amalgamated Association
of Iron, Steel, and Tin Workers, Shannon Building, Pittsburgh, Pa.

DEAR SIR: I have to acknowledge receipt of your letter of July 1, reply to which has been delayed in the hope that the action indicated by you therein would not be taken. As you have now, however, called from their works the workmen of the Tin Plate Co. who are members of your association, I can not permit the statements in your letter to go unchallenged.

The agreement relating to the scale rate between the Amalgamated Association of Iron, Steel, and Tin Workers and this company was signed deliberately and after full consultation and consideration, and nothing has been done or proposed by this company in violation of that agreement. The fact that your association has a grievance against any other company is no justification for a deliberate violation of its agreement with us. It seems to me most deplorable that our workmen, who were earning good wages, with which they were entirely satisfied, and who have no grievance, should be deliberately called away from their work under such circumstances.

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6297.

[2] Idem, p. 6298.

Yours, truly,

AMERICAN TIN PLATE CO.,
WARNER ARMES, *Second Vice President.*[1]

After the strike order of July 1 was issued arrangements were made, in reality from the New York office of the Steel Corporation but ostensibly by the separate subsidiary companies, for a conference with the Amalgamated Association.[2] The conference was held in Pittsburgh July 11, 12, and 13, and finally a proposition was made by representatives of the companies that the American Tin Plate Co. should sign for all mills except Monessen; that the American Steel Hoop Co. should sign for all mills recognized in the previous year; and that the American Sheet Steel Co. should sign for all mills which had been signed for the previous year, with the addition of the mills at McKeesport, Saltsburg, and Scottdale, Pa., and Wellsville, Ohio[3] (where 12 men had recently been discharged for attempting to form a lodge[4]). This offer, it may be noted, gave the association six more union mills than had been granted at the beginning of the strike. The offer, however, was rejected, the principal reasons given by the union officials being that hundreds of men in the hoop mills had come out on strike and that nothing was gained for them by the proposed settlement.[5]

On July 2, the day following the first strike order and the letter to the American Tin Plate Co., which has been quoted above, the following circular was issued calling out the tin workers on July 8 unless a settlement of the strike was arranged previously:

PITTSBURGH, PA., *July 2, 1901.*

To the tin-plate workers of the Amalgamated Association.

BRETHREN: The constitution, Article XIX, section 35, states: "Should one mill in a combine or trust have a difficulty, all mills in said combine or trust shall cease work until such grievance is settled."

The sheet-mill men and the boilers and finishers of the Steel Hoop Co. are out on strike for the signing of the scale. If this grievance is not settled by Monday, July 8, the above-quoted part of our constitution will be enforced, and all tin-mill workers under the jurisdiction of the A. A. are expected to cease work at the above-named date.

Please notify your managers at once and be ready when the call shall be issued by your national office. It is understood that no action will be taken by the lodges until requested by the national office.

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6299.

[2] Minutes, executive committee United States Steel Corporation, July 6, 1901.

[3] Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6300.

[4] Minutes, executive committee United States Steel Corporation, July 8, 1901.

[5] Report of President Shaffer, Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6304.

> Brethren, we are compelled to this course by the action of the United States Steel Trust, which, organized against the law of our country, tries to prevent the working people to organize, when the law of our land permits us to do so.[1]

This order, however, was suspended until after the conferences of July 11 to 13, but went into effect on July 15, on which day the tin workers of the Amalgamated Association and many nonunion men went on strike. This action in calling upon the members of the Amalgamated Association to violate their contract with the American Tin Plate Co. alienated a great deal of public support and also prevented the strikers themselves from being thoroughly unified.

In the meantime efforts were being made by both sides and by outside parties to arrange for a settlement. The obstacles in the way were not great and both sides, apparently, were desirous of avoiding a long strike; but nothing was accomplished. On August 6, after the failure of these conferences and attempts at settlement, the men in the steel works of the corporation were summoned by the Amalgamated Association to stop work by the following order:

> PITTSBURGH, PA., *August 6, 1901.*
>
> BRETHREN: The officials of the United States Steel Trust have refused to recognize as union men those who are now striking for the right to organize.
>
> The executive board has authorized me to issue a call upon all amalgamated and other union men in name and heart to join in the movement to fight for labor's right. We must fight or give up forever our personal liberty. You will be told that you have signed contracts, but you never agreed to surrender those contracts to the United States Steel Co. Its officers think you were sold to them as the mills were, contracts and all. Remember, before you agreed to this contract you took an obligation to the A. A. It now calls you to help in this its hour of need. Unless the trouble is settled on or before Saturday, August 10, 1901, the mills will close when the last turn is made on that day.
>
> Brethren, this is the call to preserve our organization. We trust you and need you. Come and help us, and may right come to a just cause.
>
> Fraternally, yours,
>
> T. J. SHAFFER, *President.*[2]

In response to this call the men in the New Castle and Mingo Junction works of the National Steel Co. and the Frankstown and Republic mills of the National Tube Co. quit work on August 10, 1901, but the men in the three mills of the Illinois Steel Co., whose relations with the company had been unusually amicable, at first refused to respond. Some of the men at the Joliet and Milwaukee works later came out under protest, but they were so few in number as to affect only slightly the operation of the mills. The men in the Chicago plants with one or two exceptions positively refused to obey the order, and the charters of their locals were accordingly revoked.

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6300.

[2] Idem, p. 6305.

In extenuation of the action in calling upon the men of the American Tin Plate Co. to strike after the contracts had been signed, the officials of the Amalgamated Association pointed out that the contract with the Amalgamated Association was in some degree, at least, provisional upon the signing of the scale by the American Sheet Steel Co. for all its mills.[1]

As a matter of fact, however, the scales were finally signed and included no provision for any reconsideration, except possibly an oral agreement regarding the Monessen plant (see p. 122). No such extenuation can be urged with regard to the contracts of the National Steel Co., the National Tube Co., and the Illinois Steel Co. Some of these scales, in fact, were signed during the progress of the strike.

The popular support and sympathy which the Amalgamated Association expected it would receive in this fight against the newly formed corporation failed in large measure to materialize, and after the failure of the men in the western mills to go on strike, fruitless efforts were made by the Amalgamated Association to secure an arbitration of the dispute. Nothing was accomplished in this direction; and the strike dragged on until the middle of September, when it was settled by the following agreement:[2]

AMERICAN TIN PLATE.

First. Scale shall be the prices agreed upon at Cleveland, and found in scale book.

Second. This contract is between the A. A. and the A. T. P. Co., the latter being a distinct and separate company in itself.

Third. The company reserves the right to discharge any employee who shall, by interference, abuse, or constraint, prevent another from peaceably following his vocation without reference to connection with labor organizations.

Fourth. Nonunion mills shall be represented as such, no attempts made to organize, nor charters granted; old charters retained by men if they desire.

Fifth. Individual agreements shall be made for mills of improved character, until they are developed, when scales shall be made to govern.

Sixth. Scale is signed for mills named below: Ellwood, Ind.; Middletown, Ind.; Anderson, Ind.; Atlanta, Ind.; Lisbon, Cannonsburg, Elwood City, Falcon, Joliet, Connellsville, Johnstown, La Belle, Laughlin, Gas City, New Kensington (2 mills), New Castle (2 mills), Muskegon, Canal Dover.

Seventh. Agreed that the company shall not hold prejudice against employees by reason of their membership with the A. A.

Eighth. This agreement is to remain in force three years from July 1, 1901, but terminable at 90 days' notice from either party on or after October 1, 1902.

SHEET STEEL CO.

Scale as printed is signed for mills of last year but Hyde Park.

STEEL HOOP CO.

Scale as printed signed for mills signed for last year.

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6295.

[2] Idem, p. 6320.

By this settlement the association not only lost 14 mills of the American Tin Plate Co., in which it had for many years been in practically complete control, but the mills for which the scale was signed were largely inefficient mills which would be likely to receive only a small quota of orders. This is shown by the fact that of the 20 mills granted to the Amalgamated Association 12 have since been abandoned and dismantled by the American Tin Plate Co. As a matter of fact, the situation was really very much worse than this, because, according to the records of the Steel Corporation,[1] three of these mills—Atlanta, Joliet, and Canal Dover—had already been definitely abandoned for dismantlement when the agreement was offered, while five others were marked for abandonment during the scale year. This left the Amalgamated Association 12 active mills, of which only 8 could be ranked as first class. Practically all the strongest mills of the American Tin Plate Co., American Sheet Steel Co., and American Steel Hoop Co. were classed as nonunion; and in ordinary times, with a moderate demand, these mills could take care of practically all orders. The settlement was, therefore, very much more disadvantageous for the association than could well have been foreseen at the time, and by the settlement the Amalgamated Association gained very much less than had been offered by the Steel Corporation at any time during the early part of the strike. Furthermore, its provisions contained several clauses which were extremely distasteful to the association. For example, clause 2 contained a direct withdrawal of the provision of the constitution with reference to sympathetic strikes against the mills of corporations which had brought about the strike. Clause 3, while skillfully worded, practically tied the hands of the union men with reference to the nonunion men who might work in the same mills with them. Clause 4 bound the union not to attempt to extend its organization in the new mills or to grant charters even where there might be a nucleus of union men. Clause 5 largely got rid of the difficulties which had attended the settlement of conditions for new mills and processes.[2]

This settlement was very distasteful to a large number of the members of the Amalgamated Association and the officials were severely criticised for having allowed it to be made.

The results of the strike were disastrous, the settlement had lost 14 mills, the cost had been tremendous,[3] and internal dissensions had been provoked which greatly weakened the Amalgamated Association. The records of the association do not show any immediate decline of membership, but rather a slight increase following the strike. This membership, however, was badly scattered, and therefore very ineffective as compared with an even smaller membership in other periods.

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[1] Hearings before the Committee on Investigation of United States Steel Corporation, House of Representatives, p. 4363.

[2] It is true that there were a number of special scales provided by the association for special mills, but this was largely confined to the steel mills, and special scales had always been strenuously opposed for all sheet and tin mills.

[3] The president, T. J. Shaffer, estimated the total cost of the strike to the workmen as a little less than $1,500,000, the expenses of the association being $200,000 and the loss in wages $1,200,000. (Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6343.)

From 1902 to 1907 the history of the association was comparatively uneventful, except for a number of strikes in the iron branch of the industry, many of which terminated in the loss of strength by the association and in the loss of the mills of the American Steel Hoop Co., which during this period was merged into the Carnegie Steel Co. During this period, however, the association instituted a system of death benefits, which was later extended to cover sickness and accidents. A great deal was done also in perfecting the organization and in putting the business of the association on a better and more uniform basis. During this period of readjustment a further loss of membership resulted from the secession of a large number of men in the puddling mills. At the organization of the Amalgamated Association, it will be remembered, the Sons of Vulcan, representing the puddlers, were dominant and they retained their dominant position during a long period. In the continued readjustments within the union the men in the other departments, which were rapidly growing in importance in the steel industry, gained more and more power and finally came to dominate the association. This in itself was sufficient to cause jealousy on the part of the puddlers, but they also believed that in the arrangement of scales for the different branches of the industry the puddlers did not receive as good wages in proportion as the men in the other branches of the industry obtained. Furthermore, the puddlers, who were an extremely conservative set of men in their attitude toward innovations, were entirely out of sympathy with the proposals for a broad extension of the benefit features of the association and for the inclusion within the ranks of the organization of all classes of labor.

In 1907 the secession of the puddlers from the association took place, and a separate organization known as the Sons of Vulcan was formed. They adopted almost bodily the constitution and scales of the Amalgamated Association with the elimination of the benefit features against which they had protested. According to their reports they had 1,265 members and 15 lodges at the time of the 1907 convention. In 1911 the membership was reported to be 1,375, with 13 lodges. The defection of this number of men, of course, greatly weakened the association, but even more trouble was caused by the frequent jurisdictional disputes which arose between the Amalgamated Association and the Sons of Vulcan. One plant was shut down for several weeks because the Sons of Vulcan were in charge of the puddling department and the Amalgamated Association was in charge of the finishing departments. Each side refused to work if the members of the other union were allowed to remain, while neither union was able to furnish the men to operate the department of the mill which it did not control. Through such disputes a number of iron mills which had formerly been organized were lost to both unions. It may be noted, however, that the loss of the puddlers, while weakening the association numerically, tended to eliminate a large part of the internal dissensions.

As far as the Steel Corporation was concerned, the period following 1902 was outwardly a period of neutrality, during which, nevertheless, the Amalgamated Association continued to lose one mill after another, so that in 1908 only 14 mills of the Steel Corporation were recognized as union mills, and of these 14 at least 2 mills had at this time definitely been abandoned. All the mills of the American Steel Hoop Co. had been lost during this period, in which they had been transferred to the Carnegie Steel Co.

In 1909 the American Sheet & Tin Plate Co. assumed the initiative in its dealings with the association, and by doing so precipitated the struggle which terminated the existence of the Amalgamated Association in the plants controlled by the United States Steel Corporation.

In 1908 the wage-scale agreement was entered into between the Amalgamated Association and the American Sheet & Tin Plate Co. for the following plants:[1]

Tin mills:
    American Works, Elwood, Ind.
    Morewood Works, Gas City, Ind.
    Anderson Works, Anderson, Ind.
    Laughlin Works, Martins Ferry, Ohio.
    La Belle Works, Wheeling, W. Va.
    Falcon Works, Niles, Ohio.
    New Castle Works, New Castle, Pa.
    Shenango Works, New Castle, Pa.
    Sharon Works, South Sharon, Pa.
    Humbert Works, Connellsville, Pa.
Sheet mills:
    Ætna-Standard Works, Bridgeport, Ohio.
    Piqua Works, Struthers, Ohio.
    Guernsey Works, Cambridge, Ohio.
    Midland Works, Muncie, Ind.

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1910, p. 8875.

This scale expired on June 30, 1909. On June 1, 1909, the American Sheet & Tin Plate Co. posted in the above-mentioned mills the following notice:

> After a careful consideration of the interests of both the company and its employees, the American Sheet & Tin Plate Co. has decided that all its plants after June 30, 1909, will be operated as "open" plants. The scale of wages in the hot-mills department commencing July 1, 1909, and until further notice will be as follows for gross ton weights: [See comparative scale below.]

This notice, it will be seen, consisted essentially of two parts: First, a statement that thereafter no agreements would be entered into with the union and, second, a provision for a new scale of wages. A comparison of this scale with the Amalgamated Association scale of the preceding year is given in the following table:

TIN-MILL SCALE OF THE AMERICAN SHEET & TIN PLATE CO. FOR 1909-10 COMPARED WITH SCALE OF THE AMALGAMATED ASSOCIATION OF IRON, STEEL, AND TIN WORKERS IN FORCE DURING 1908-9.

[Rates are per gross ton of 2,240 pounds.]

Gauge numbers.	Rollers.			Doublers.			Heaters.		
	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of decrease.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of decrease.	A. A. I. S. & T. W.	A. S. & T. P.. Co.	Per cent of decrease.
8 to 11	$1.32	$1.29	2.3	$0.75	$0.73	2.7	$0.80	$0.74	7.5
12 and 13	1.38	1.35	2.2	.77	.75	2.6	.84	.77	8.3
14 and 15	1.60	1.56	2.5	.89	.88	1.1	1.01	.93	7.9
16 and 17	2.13	2.08	2.3	1.22	1.19	2.5	1.25	1.14	8.8
18 to 20	2.39	2.33	2.5	1.36	1.33	2.2	1.39	1.28	7.9
21 to 24	2.87	2.80	2.4	1.69	1.65	2.4	1.66	1.52	8.4
25 and 26	3.04	2.97	2.3	1.78	1.73	2.8	1.82	1.67	8.2
27 and 28	3.07	3.00	2.3	1.87	1.82	2.7	1.97	1.80	8.6
29 and 30	3.22	3.14	2.5	2.12	2.07	2.4	2.20	2.02	8.2
31	3.30	3.22	2.4	2.25	2.19	2.7	2.35	2.15	8.5
32	3.45	3.36	2.6	2.36	2.30	2.5	2.47	2,27	8.1
33	3.67	3.58	2.5	2.48	2.42	2.4	2.54	2.33	8.3
34	4.08	3.98	2.5	2.65	2.59	2.3	2.78	2.55	8.3
35	4.27	4.16	2.6	2.79	2.72	2.5	2.96	2.71	8.1
36	4.56	4.44	2.6	2.87	2.80	2.4	3.07	2.81	8.5
37	4.62	4.51	2.4	2.90	2.82	2.8	3.11	2.86	8.0
38	4.66	4.56	2.1	2.96	2.89	2.4	3.16	2.90	8.2
39	4.92	4.92	....	3.25	3.46	[1]6.5	3.39	3.39	....
40	5.18	5.18	....	3.68	3.91	[1]6.3	3.96	3.96	....

[1] Increase.

TIN-MILL SCALE OF THE AMERICAN SHEET & TIN PLATE CO. FOR 1909–10 COMPARED WITH SCALE OF THE AMALGAMATED ASSOCIATION OF IRON, STEEL, AND TIN WORKERS IN FORCE DURING 1908–9—Concluded.

Gauge numbers.	Catchers.			Shearmen			Screw boys.			Total.		
	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of decrease.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of decrease.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of decrease.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of decrease.
8 to 11	$0.45	$0.44	2.2	$0.32	$0.31	3.1	$0.54	$0.52	3.7	$4.18	$4.03	3.6
12 and 13	.48	.46	4.2	.32	.31	3.1	.54	.52	3.7	4.33	4.16	3.9
14 and 15	.55	.54	1.8	.32	.31	3.1	.54	.52	3.7	4.91	4.74	3.5
16 and 17	.73	.71	2.7	.32	.31	3.1	.54	.52	3.7	6.19	5.95	3.9
18 to 20	.82	.79	3.7	.32	.31	3.1	.54	.52	3.7	6.82	6.56	3.8
21 to 24	.90	.88	2.2	.39	.37	5.1	.65	.62	4.6	8.16	7.84	3.9
25 and 26	.96	.94	2.1	.39	.38	2.6	.71	.69	2.8	8.70	8.38	3.7
27 and 28	.96	.94	2.1	.40	.40	....	.72	.70	2.8	8.99	8.66	3.7
29 and 30	1.10	1.07	2.7	.40	.39	2.5	.72	.70	2.8	9.76	9.39	3.8
31	1.12	1.09	2.7	.40	.40	....	.73	.71	2.7	10.15	9.76	3.8
32	1.18	1.14	3.4	.42	.41	2.4	.75	.72	4.0	10.63	10.20	4.0
33	1.24	1.22	1.6	.45	.44	2.2	.77	.74	3.9	11.15	10.73	3.8
34	1.37	1.34	2.2	.47	.46	2.1	.80	.77	3.8	12.15	11.69	3.8
35	1.45	1.41	2.8	.49	.47	4.1	.83	.80	3.6	12.78	12.27	4.0
36	1.54	1.51	1.9	.51	.49	3.9	.83	.80	3.6	13.38	12.85	4.0
37	1.56	1.52	2.6	.53	.52	1.9	.83	.80	3.6	13.55	13.03	3.8
38	1.58	1.55	1.9	.54	.53	1.9	.83	.80	3.6	13.73	13.23	3.6
39	1.66	1.77	[1] 6.6	.55	.59	[1] 7.3	.83	.88	[1] 6.0	14.60	15.01	[1] 2.8
40	1.75	1.86	[1] 6.3	.57	.61	[1] 7.0	.83	.88	[1] 6.0	15.97	16.40	[1] 2.7

[1] Increase.

It may be briefly stated that the scale amounted to a reduction for the entire crew of from 3.5 to 4 per cent, depending on the gauge of the product. The heaviest reduction was in the case of the heater, the reduction on the various gauges ranging from 7.5 to 8.8 per cent. This reduction, moreover, carried with it the elimination of the "sliding-scale" feature which had characterized all previous agreements of the Amalgamated Association. The scale as printed by the Amalgamated Association gave the wages which would be paid when tin plates were selling at or below a certain fixed minimum ($3.90 per box of 100 pounds), and provided that when the price of tin plates advanced 10 cents per box the wages should be advanced 2 per cent. This sliding-scale feature, therefore, gave the opportunity for wages to advance above the figures specified in the scale. As a matter of fact, however, tin plate had not sold above $3.90 since October, 1902, as shown by the average monthly prices printed in the annual reports of the American Iron and Steel Association. In June, 1909, the average price at the mills in Pennsylvania was $3.40 per box of 100 pounds, and except as a matter of principle, therefore, the loss of the sliding scale would not immediately have been of any particular importance. It had, however, been so generally a matter of principle with the Amalgamated Association and had from the beginning worked so advantageously that its elimination was of considerable importance. Furthermore, the agreements in previous years had contained a large number of foot notes which specified very clearly the rights of the workmen with regard to specific working conditions, some of which were regarded as of the greatest importance by the members of the Amalgamated Association. Practically all of these minor clauses in the agreement were omitted from the proposition offered by the American Sheet & Tin Plate Co.

Immediately after the posting of these notices an attempt was made by the officials of the Amalgamated Association to secure a conference, but conferences were refused both by the officials of the American Sheet & Tin Plate Co. and by the officials of the Steel Corporation, who declined to intervene in the matter. The Amalgamated Association considered that this refusal left no alternative except to strike, since an acceptance of the conditions offered would mean a complete loss of the power of the union in this branch of the industry, accompanied by a reduction of wages. The members of the Amalgamated Association in all but one of the mills named above ceased work on July 1, 1909, and in many of the mills they were joined by a large number of men who were not union members. In a number of these mills the men had been idle for a large part of the time owing to the fact pointed out above that many of these mills were inefficient and had definitely been set apart for abandonment. The workmen, therefore, were not in an advantageous position to undergo a long strike, and this undoubtedly accounts for the failure of the men in one of the mills to respond to the strike order.

The association from the beginning of the strike received strong support from the American Federation of Labor and was therefore enabled to continue the strike much longer than would have been possible if it had been forced to depend upon its own resources. The American Sheet & Tin Plate Co. succeeded in securing men to operate a number of its mills and, while undoubtedly affected by the strike, within a short time had succeeded in making such arrangements that it was not dependent to any considerable extent on having members of the Amalgamated Association return to work. Repeated efforts were made during the strike to organize the workmen in the so-called nonunion mills, particularly those in the large and newly constructed plant at Vandergrift, Pa. These attempts on the part of the association were unsuccessful in large part because their organizers were prevented from holding meetings in the towns in which the plants were located. The affidavits of a number of organizers and union officials on this subject are printed in Appendix E, page 507.

The aggressive position of the American Sheet & Tin Plate Co. was maintained throughout the strike, and the Amalgamated Association was unable to secure sufficient strength to bring about any kind of a settlement with the American Sheet & Tin Plate Co. On May 1, 1910, the American Sheet & Tin Plate Co. advanced its tonnage rates, making them higher than the Amalgamated scale, as shown in the following table:

TIN-MILL SCALE OF THE AMERICAN SHEET & TIN PLATE CO. COMPARED WITH SCALE OF THE AMALGAMATED ASSOCIATION OF IRON, STEEL, AND TIN WORKERS, 1910 TO 1912.[1]

[Rates are per gross ton of 2,240 pounds.]

Gauge numbers.	Rollers.			Doublers.			Heaters.		
	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.
8 to 11	$1.32	$1.33	0.8	$0.75	$0.75	....	$0.80	$0.81	1.3
12 and 13	1.38	1.39	.7	.77	.77	....	.84	.85	1.2
14 and 15	1.60	1.61	.6	.89	.91	2.2	1.01	1.02	1.0
16 and 17	2.13	2.14	.5	1.22	1.23	.8	1.25	1.25	....
18 to 20	2.39	2.40	.4	1.36	1.37	.7	1.39	1.41	1.4
21 to 24	2.87	2.88	.3	1.69	1.69	....	1.66	1.70	2.4
25 and 26	3.04	3.06	.7	1.78	1.78	....	1.82	1.84	1.1
27 and 28	3.07	3.09	.7	1.87	1.87	....	1.97	1.98	.5
29 and 30	3.22	3.23	.3	2.12	2.13	.5	2.20	2.22	.9
31	3.30	3.32	.6	2.25	2.26	.4	2.35	2.36	.4
32	3.45	3.46	.3	2.36	2.37	.4	2.47	2.50	1.2
33	3.67	3.69	.5	2.48	2.49	.4	2.54	2.56	.8
34	4.08	4.10	.5	2.65	2.67	.8	2.78	2.80	.7

Gauge numbers.	Catchers.			Screw boys.			Total.		
	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.
8 to 11	$0.45	$0.45	....	$0.54	$0.54	....	$3.86	$3.88	0.5
12 and 13	.48	.48	....	.54	.54	....	4.01	4.03	.5
14 and 15	.55	.56	1.8	.54	.54	....	4.59	4.64	1.1
16 and 17	.73	.73	....	.54	.54	....	5.87	5.89	.3
18 to 20	.82	.82	....	.54	.54	....	6.50	6.54	.6
21 to 24	.90	.91	1.1	.65	.65	....	7.77	7.83	.8
25 and 26	.96	.97	1.0	.71	.71	....	8.31	8.36	.6
27 and 28	.96	.97	1.0	.72	.72	....	8.59	8.63	.5
29 and 30	1.10	1.10	....	.72	.72	....	9.36	9.40	.4
31	1.12	1.12	....	.73	.73	....	9.75	9.79	.4
32	1.18	1.18	....	.75	.75	....	10.21	10.26	.5
33	1.24	1.26	1.6	.77	.77	....	10.70	10.77	.7
34	1.37	1.38	.7	.80	.80	....	11.68	11.75	.6

[1] The rates paid the shearman are not shown separately nor included in the table, since in the scale of the American Sheet & Tin Plate Co. the shearman's rate is combined with that of shearman's helper and opener.

SHEET-MILL SCALE OF THE AMERICAN SHEET & TIN PLATE CO. COMPARED WITH SCALE OF THE AMALGAMATED ASSOCIATION OF IRON, STEEL, AND TIN WORKERS, 1910 TO 1912.

[Rates are per gross ton of 2,240 pounds.]

Gauge numbers.	Rollers.			Sheet heaters and helpers.			Shearmen.		
	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.
8 and heavier	$0.903	$0.879	[1]2.7	$0.723	$0.742	2.6	$0.412	$0.423	2.7
9 to 11	1.003	.976	[1]2.7	.803	.824	2.6	.459	.471	2.6
12 to 14	1.206	1.170	[1]3.0	.965	.989	2.5	.553	.564	2.0
15 to 17	1.428	1.415	[1].8	1.115	1.143	2.5	.637	.653	2.5
18 to 21	1.774	1.791	1.0	1.355	1.390	2.6	.774	.794	2.6
22 to 24	2.319	2.335	.7	1.768	1.813	2.5	1.010	1.035	2.5
25 and 26	2.664	2.685	.8	2.033	2.085	2.6	1.162	1.192	2.6
27	2.895	2.919	.8	2.209	2.266	2.6	1.263	1.295	2.5
28	3.081	3.108	.9	2.352	2.412	2.6	1.343	1.378	2.6
29	3.236	3.264	.9	2.472	2.534	2.5	1.412	1.447	2.5
30	3.472	3.502	.9	2.650	2.719	2.6	1.515	1.554	2.6
31	4.501	4.537	.8	3.434	3.523	2.6	1.963	2.013	2.5
32	5.478	5.519	.7	4.179	4.285	2.5	2.381	2.448	2.8

[1] Decrease.

SHEET-MILL SCALE OF THE AMERICAN SHEET & TIN PLATE CO. COMPARED WITH SCALE OF THE AMALGAMATED ASSOCIATION OF IRON, STEEL, AND TIN WORKERS, 1910 TO 1912—Concluded.

Gauge numbers.	Pair heaters.			Roughers.			Catchers		
	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.
8 and heavier	$0.270	$0.278	3.0	$0.350	$0.360	2.9	$0.350	$0.360	2.9
9 to 11	.300	.309	3.0	.390	.402	3.1	.390	.402	3.1
12 to 14	.360	.371	3.1	.468	.482	3.0	.468	.482	3.0
15 to 17	.416	.428	2.9	.523	.539	3.1	.523	.539	3.1
18 to 21	.506	.521	3.0	.615	.633	2.9	.615	.633	2.9
22 to 24	.660	.680	3.0	.802	.826	3.0	.802	.826	3.0
25 and 26	.759	.782	3.0	.923	.951	3.0	.923	.951	3.0
27	.825	.850	3.0	1.003	1.033	3.0	1.003	1.033	3.0
28	.878	.904	3.0	1.068	1.100	3.0	1.068	1.100	3.0
29	.922	.950	3.0	1.122	1.156	3.0	1.122	1.156	3.0
30	.990	1.020	3.0	1.204	1.240	3.0	1.204	1.240	3.0
31	1.282	1.320	3.0	1.559	1.606	3.0	1.559	1.606	3.0
32	1.560	1.607	3.0	1.897	1.954	3.0	1.897	1.954	3.0

Gauge numbers.	Matchers.			Doublers.			Total		
	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.	A. A. I. S. & T. W.	A. S. & T. P. Co.	Per cent of increase.
8 and heavier	$0.248	$0.255	2.8	$0.234	$0.241	3.0	$3.490	$3.538	1.4
9 to 11	.275	.283	2.9	.260	.268	3.1	3.880	3.935	1.4
12 to 14	.331	.341	3.0	.312	.321	2.9	4.663	4.720	1.2
15 to 17	.370	.381	3.0	.349	.359	2.9	5.359	5.457	1.8
18 to 21	.437	.450	3.0	.411	.423	2.9	6.487	6.635	2.3
22 to 24	.570	.587	3.0	.536	.552	3.0	8.467	8.654	2.2
25 and 26	.656	.676	3.0	.616	.634	2.9	9.736	9.956	2.3
27	.713	.734	2.9	.670	.690	3.0	10.581	10.820	2.3
28	.759	.782	3.0	.713	.734	2.9	11.262	11.518	2.3
29	.797	.821	3.0	.749	.771	2.9	11.832	12.099	2.3
30	.855	.881	3.0	.804	.828	3.0	12.694	12.984	2.3
31	1.108	1.141	3.0	1.042	1.073	3.0	16.448	16.819	2.3
32	1.347	1.387	3.0	1.267	1.305	3.0	20.006	20.459	2.3

This increase in wages was effective in still further weakening the position of the Amalgamated Association, and from this time forward the strike was rapidly losing strength.

The strike lasted for 14 months, being declared off on August 27, 1910. This practically completes the active history of the Amalgamated Association. Since 1909 the membership has declined, until in 1911 the total membership of the association numbered only 4,355, of whom 2,239 were members of the bar-iron division, which includes the puddlers and the men in the iron-finishing mills. Attempts have since been made, as will be pointed out more fully later, to extend the membership and to reconstruct the organization along more effective lines. These efforts, however, have been almost entirely fruitless, and with the exception of the iron mills the Amalgamated Association now may be regarded as practically powerless in any way to control the working conditions in the industry.

The following table shows in summary form the progress of the Amalgamated Association during each year of its history:

NUMERICAL AND FINANCIAL GROWTH AND DECLINE OF THE AMALGAMATED ASSOCIATION OF IRON, STEEL, AND TIN WORKERS, 1877 TO 1911.

[From Journal of Proceedings, National Lodge Amalgamated Association, 1911, p. 9307.]

Convention held at—	Year.	Delegates in attendance.	Number of active lodges.	Total membership.	Average membership per lodge.	Total receipts from all sources.	Total disbursements for all purposes.	Balance in the treasury.
Columbus, Ohio..	1877	77	111	3,755	34	$5,065.49	$3,162.83	$802.96
Wheeling, W. Va.	1878	91	110	4,044	37	4,931.81	3,004.89	912.47
Youngstown, Ohio...........	1879	104	104	5,500	52	15,754.30	12,423.71	1,664.59
Pittsburgh, Pa...	1880	192	155	9,550	62	20,963.84	13,972.42	6,991.20
Cleveland, Ohio..	1881	173	166	10,359	62	39,554.40	27,150.98	12,393.42
Chicago, Ill.......	1882	213	197	16,003	81	91,166.83	66,239.98	24,826.94
Philadelphia, Pa.	1883	153	183	11,800	64	109,711.31	96,823.65	12,877.66
Pittsburgh, Pa...	1884	149	160	9,242	58	50.251.37	31,959.84	18,291.53
Wheeling, W.Va.	1885	88	107	5,702	53	44,324.82	16,042.55	28,282.27
Pittsburgh, Pa...	1886	121	106	7,219	68	45,553.26	35,601.98	9,921.28
Pittsburgh, Pa...	1887	172	154	11,426	74	42,522.78	11,774.66	30,748.11
Pittsburgh, Pa...	1888	194	172	14,946	87	81,173.01	24,206.21	56,966.80
Pittsburgh, Pa...	1889	94	189	16,117	85	112,338.19	40,661.15	71,677.04
Pittsburgh, Pa...	1890	253	234	20,781	88	138,919.01	38,460.16	100,458.85
Pittsburgh, Pa...	1891	294	290	24,068	83	173,231.27	26,690.04	146,541.23
Pittsburgh, Pa...	1892	254	291	20,975	72	226,265.49	150,544.33	75,716.16
Pittsburgh, Pa...	1893	152	234	13,613	58	211,347.13	178,741.71	32,605.42
Cleveland, Ohio..	1894	96	150	10,000	66	57,974.34	42,404.71	15,542.64
Cleveland, Ohio..	1895	85	125	10,000	80	34,539.57	21,048.40	13,491.17
Detroit, Mich....	1896	115	132	11,000	83	35,781.72	12,525.76	23,255.96
Detroit, Mich....	1897	123	145	10,500	72	44,426.65	15,962.96	28,463.69
Cincinnati, Ohio .	1898	118	153	10,500	65	52,663.62	25,830.65	26,832.97
Detroit, Mich....	1899	140	145	11,050	76	57,070.90	22,202.62	34,868.28
Indianapolis, Ind	1900	202	181	14,035	77	84,307.81	27,364.40	56,943.41
Milwaukee, Wis..	1901	200	160	13,892	87	119,659.07	44,760.33	74,898.74
Wheeling, W. Va.	1902	211	174	14,467	83	273,906.01	169,710.50	104,195.51
Columbus, Ohio..	1903	200	185	15,198	82	183,897.81	51,172.16	132,725.65
Cleveland, Ohio..	1904	207	183	14,306	79	208,065.67	83,318.99	124,746.68
Detroit, Mich....	1905	166	157	10,904	69	203,243.04	155,730.75	47,512.29
Cincinnati, Ohio .	1906	170	144	11,410	79	129,383.15	89,758.60	39,624.55
Toledo, Ohio.....	1907	150	139	10,216	73	135,321.56	85,745.00	49,576.56
Youngstown, Ohio...........	1908	115	124	7,472	60	125,710.53	67,899.40	57,811.13
Detroit, Mich....	1909	95	114	6,295	55	125,895.54	79,546.14	46,349.40
Fort Wayne, Ind.	1910	116	103	8,257	80	247,981.96	218,634.62	29,347.34
Canton, Ohio.....	1911	72	85	4,355	73	204,847.58	164,180.88	40,666.70

PRESENT RELATIONS OF EMPLOYERS AND WORKMEN.

At present (1912) out of a total of 275,000 employees in the iron and steel industry, the two unions of ironworkers, the Amalgamated Association and the Sons of Vulcan, have a membership of 5,730. This membership is limited to the puddling mills, the small rolling mills, and the sheet and tin plate mills. Even in these mills the union members constitute less than one-fourth of the employees in the occupations to which the union membership is practically confined. In none of the manufacturing plants of the United States Steel Corporation is there any form of labor organization, although in various plants a few workmen are employed who still hold union cards either in the Amalgamated Association or in one of the unions of the mechanical trades. Of the large independent companies there are only two of which have any dealings with the ironworkers' unions, and in both cases the scale is signed only for the puddling mills and the small rolling mills, which are operated by hand. In the blast furnaces, steel works, and the large mechanically operated mills no union men are employed.

The membership of the two unions is practically confined to the plants operated by members of the Western Bar Iron Association, a few isolated bar-iron manufacturers not members of the association, and a number of independent sheet and tin plate mills. The two unions had 4,154 members in the iron branch of the industry and 1,576 members in the sheet and tin plate branch.

The relations of employers and workmen in the small nonunion plants present no features of interest. Little attention is ordinarily paid to the union affiliations of employees in most of the small mills, unless the plant has recently become nonunion or the manager has reason to suspect that an attempt is being made to organize a local lodge in his mill. The conditions which exist in any small nonunion mill depend almost entirely on the attitude of the local manager rather than upon a settled policy, as in the case of the large corporations. A discussion of the situation in such plants would be merely a description of the varying conditions found in different establishments at the time of the investigation, from which it would be impossible to generalize, and which might be totally altered by a change in local conditions. The discussion of the relations of employers and workmen is, therefore, limited to a study of the conditions existing in the plants of the United States Steel Corporation and the large independent companies and in the union plants.

In studying the Steel Corporation and the large independent companies attention is directed principally to such questions as the methods of employment and the hearing of complaints, while in considering the union plants it is directed principally to the machinery provided by the union for settling working conditions and wage scales.

THE UNITED STATES STEEL CORPORATION.

All the plants of the United States Steel Corporation are at present operated on an "open shop" basis. This situation has existed since the end of the tin plate strike of 1909. The minutes of the executive committee of the Steel Corporation show that soon after its formation a formal resolution was passed recording the opposition of the corporation to the extension of labor unions. (Minutes of June 17, 1901.) The minutes of the same committee show that workmen were discharged from one of the mills for "endeavoring to institute a lodge." (Minutes of July 8, 1901.) No unions are recognized in any of the plants of the subsidiary companies, and few workmen who still retain membership in any labor organization are employed.

The method of dealing with employees in each plant is largely at the discretion of the local superintendent. In some of the plants committees of workmen are received by the general superintendent or by the department superintendents and heard on any subject that may arise. In other plants committees are received only to discuss "wages and working conditions generally," while in a number of plants committees are not heard under any circumstances, each individual workman being dealt with as a unit. In all the plants of the Steel Corporation a complete record is kept of the period of service and of the general characteristics of each workman, and the past record of the skilled workmen when working for other companies is investigated if it is deemed necessary. The methods by which this is done are fully explained under the head of "Methods of employing workmen."

The general questions of working conditions, wages, and hours of labor are settled entirely by the superintendents of the separate plants, acting, of course, with the advice and general instructions of the general officers of the subsidiary companies and of the Steel Corporation. Although committees are sometimes heard, the decision upon the questions presented by such committees is in the hands of the officials of the company. Only a very few cases could be recalled in any of the plants where committees of workmen had presented any questions. Except in a few individual cases, therefore, rates of wages and working hours are established by the promulgation of schedules fixing the conditions for each position in the plant, and these fixed conditions apply without question to every workman accepting a position in the plant. Instead, therefore, of dealing with the employees as individuals they are dealt with as a group and certain standard conditions are prescribed without reference to the ability or qualifications of the individual workman.

THE LARGE "INDEPENDENT" COMPANIES.

It is, of course, impossible to generalize as to the attitude of the so-called independent companies toward the formation of unions among their workmen. In the case of two of the large independent corporations unions are recognized in their iron mills, but not in the other departments. The seven other companies which are classed as "large independents," do not recognize any labor organization and employ no union workmen except in a few sporadic cases where a man otherwise entirely satisfactory to the company happens to hold a union card. This applies only to the manufacturing plants, for in several cases the workmen on railroads owned by these companies were found to be organized and affiliated with the railroad brotherhoods.

With the large independent companies as with the Steel Corporation, the determination of the attitude of the company toward labor organizations is largely a matter of securing adequate evidence. For the Steel Corporation it has been possible to present various documentary evidence which covers in a satisfactory manner the attitude of the corporation toward the question of labor organizations. No such evidence is available for all of the large independent companies, but in them, as in the Steel Corporation, it was found that the workmen individually believe that any attempt on their part to extend or organize unions in branches which are not recognized as being under the control of the union would result in the discharge of the men responsible for such a movement. Furthermore, it was believed by all the workmen interviewed that for any man to acknowledge his affiliation with any labor organization was likely to prejudice his interests if it did not result in his discharge. In most cases the employees were unable to present any evidence upon which to base their belief other than the statement that whenever an attempt had been made to form any labor organization the workmen interested in the organization had been discharged either immediately or so soon afterwards that the connection between their discharge and the attempt at organization was still fresh in the minds of other workmen.

In the case of one of the large independent companies, the prohibition of membership in any labor organization is positive. At the time of their employment all the employees agree to the following clause in the conditions of employment:

> **This is to certify, that I am not now connected with any labor organization; and I further agree that while in the employ of "The ——— Steel Co.," I will not in any way, directly or indirectly, join, or have anything to do with any labor organization of any kind whatever.**

A full copy of the conditions of employment of which this clause forms a part is shown on page 146.

The rates of wages and working conditions generally are fixed in the large independent companies in the same way as described in the case of the Steel Corporation. A fixed schedule is made by the company covering the different positions, and the individual workmen either accept these standard conditions or seek work elsewhere. Committees of workmen may or may not be received, at the discretion of the general manager of the particular company, as none of the companies has a specific rule covering this point. Committees are seldom formed, it was stated by the workmen interviewed, because the employees do not believe that any favorable action would result and also because it is difficult to get men to serve on such committees, as it is generally believed to prejudice a man's interest to be a member of such a committee. One of the large companies, through a local custom, has a great many petitions of workmen presented to it, and has several times changed the hours of labor in its rolling mills from 12 to 8 and in one case from 8 to 12 in accordance with such petitions. In none of these companies nor in the Steel Corporation is any method provided by which workmen can present their claims nor is there any provision for the settlement of any disputes which may arise. Each of the large steel companies reserves the right to operate its plant or plants as it chooses.

Certain general conditions are similar in all of the large plants, consequently, in order to save space, they are discussed in the following pages without reference to corporate ownership.

METHODS OF EMPLOYING WORKMEN.

All features of the relations between the employers and the workmen in nonunion plants center around and to a large degree depend upon the system by which the workmen are employed, and the conditions which they virtually accept at the time of their employment. For this reason an understanding of the methods by which workmen are ordinarily employed in the large steel plants is of considerable importance. With very few exceptions the unskilled workmen, ordinarily known in the industry as common laborers, are employed directly by the foreman, who selects the men needed to complete his gang from the crowds which gather in the morning and in the late afternoon around the gates of the mill. In a few cases the employment of this class of labor also has been put into the hands of the employment department for reasons which will be described later. For the employment of unskilled workmen, usually no records are made, except of the name, the character of the work for which employed, the date of employment, and the rate of wages at which the workmen were hired. Work of this character is paid for at a uniform rate, known as the common labor rate, which workmen receive without regard to their individual abilities or experience. For the employment of skilled workmen, however, most of the large steel plants have a centralized employment department in which elaborate records are kept of all the important facts relating to each individual workman. In order to show the elaborate machinery necessary to provide for the employment of men in a large steel plant and to indicate the character of the organization used for carrying out the employment of workmen the following description of the system used in one of the large steel plants is given in the form in which it was reported to the Bureau by the agent who visited the plant. This plant is selected both because the employment department in this particular case is very well organized and also because this company is one of those mentioned above which still employs union men in its iron mill.

OPERATIONS OF EMPLOYMENT BUREAU IN A REPRESENTATIVE PLANT.

The company has an employment bureau with its office located at the north entrance to the plant. If men are needed foremen or superintendents notify this bureau, or they may, and they frequently do, select men from the crowd which gathers in search of employment night and morning, and take them into the employment office to be hired. Foremen or superintendents may thus recommend men for employment, but the chief of the employment bureau uses his own discretion in hiring them. During the time the agent was in the employment office one boy was refused work because the chief of the bureau did not believe he was 18 years old, or if 18, not strong enough for heavy labor. Another was refused work because he had worked for the company but said that he had not done so. Another said he had worked for the company and gave his number, but the name he gave did not appear under that number, and he was turned away.

Applicants for employment are asked the questions on the following card.

THE ——— Co.

EMPLOYEE'S RECORD CARD.[1]

Date record taken..........

Record No..................

Name	Age	Nationality	Married	Dependents

Residence and changes in residence	Telephone and changes in number
Member of what labor organization	Department sent to
Trade or training	

Relatives in this company's employ	Names	Relation	Department

RECORD OF PREVIOUS EMPLOYMENT.

Employer.	Foreman.	Position.	Time.		Cause of leaving.
			From	To	
....	....	....	......	......	....
....	....	....	......	......	....
....	....	....	......	......	....
....	....	....	......	......	....
....	....	....	......	......	....
....	....	....	......	......	....

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[1] On reverse side of card are columns—1. Department; 2. Check number; 3. Position; 4. Foreman; 5. Date From, To; 6. Disposition.

If the answers are satisfactory and a position is open, the applicant is given a pass like the following, directing him to a foreman:

THE ——— Co.

EMPLOYMENT PASS.

Name..

Sent to..Dept.

Position..

Foreman..

——— ———

Chief Employment Bureau.

Following is the reverse side of this pass:

Taken up................M.............

Pay Roll No......... ....
Timekeeper.

Rate................ ....
Foreman.

Approved........... ....
Department Supt.

Recorded........... ....
Chief Employment Bureau.

Recorded........... ....
Chief Timekeeper.

The foreman fills in the rate and signs his name. The superintendent approves it. The slip is then taken to the timekeeper, who gives the applicant a brass check with a number; and the slip is returned to the employment bureau for record.

The employment bureau then makes two cards for filing, one by name, the other by number so that any employee can be quickly located in case he is transferred, is employed, quits, or is discharged.

Usually no record is made of applicants if no position is open, but for skilled employees an application may be placed on file. The following form is used:

THE —— Co.

APPLICATION FOR EMPLOYMENT.

..............................Department. ....190..

Name.........................Nationality..........................
Age........ Married........ Dependents............................
Residence...................................... Telephone.........
Physical defects (eyesight, hearing, etc.)............................
Member of what labor organizations....................................
Work desired..
Experience..
......................,......................... Have license........
Where last employed...
.................................from.............to..........
Foreman...................................Check No...........
Reasons for leaving...
References..
....
Signature.........................

In case an employee desires to transfer to another department, he procures a transfer card from his foreman and then goes through the same routine as when he first seeks employment. The back of the transfer card is a reprint of the back of the employment pass. Following is the form:

THE —— Co.

TRANSFER CARD

.............................190..

The bearer..
Pay roll check No..................................
Brass check No.....................................

HAS THIS DAY BEEN TRANSFERRED

From...................................Department
To.....................................Department
Signed..........................*Supt*.........................*Dept.*

The employment department is open from 5 a. m. to 7 p. m. It is in charge of the chief and one assistant.

As indicated by the above forms, applicants for employment are asked as to their union affiliations. If they are puddlers and are union men they are employed, as the puddler's union, the Sons of Vulcan, is recognized by the company. Other union men are not hired. The usual method in such cases, as stated by the chief of the employment department, is to inform men who acknowledge union affiliations that there is no position open at present, and that if they are wanted later they will be notified. They are not wanted later. The chief of the employment department said he had "turned down" many good-looking men for this reason. On some occasions he had found that men whom he had hired were union men, although they had denied it. He then notified the superintendent of the department. The superintendent usually went to these men and informed them that the company maintained an open shop, but that they could remain if they were satisfied to work under open-shop conditions.

In case an applicant for work in the mill replies that he was formerly employed here but quit at the time of the strike two years ago he is told, according to the chief of the employment department, that no position is open, and if upon inquiry he is found to have been a trouble maker he is not sent for.

As a matter of fact, few union men apply for work here, except in the puddling department. In the opinion of the chief of the employment department no union men are now employed except in the puddling department.

The puddlers and muck bar mill roll hands are organized. Their union—the United Sons of Vulcan—is recognized, but no other is. Committees of men are received and heard on all points.

Workmen are discharged by foremen and superintendent. To make the employee's record complete, and also to prevent grafting, a "cause slip" must be made out showing why a man is discharged, signed by the foreman and approved by the department superintendent. Following is the form used:

THE ——— Co.

CAUSE SLIP.

......................191...

Chief Employment Bureau:

....

Position........................Pay roll No.........

who left the employ of the Company at......M. 191 ..

Cause for leaving...................................

....

....

....

Foreman.

CONDITIONS IN OTHER PLANTS.

At many of the steel plants the inquiry as to whether a workman is a member of a labor organization is not asked, both because this particular fact has through the weakness of the union lost all of its former significance, with the exception of a few plants such as the one described above, and also because there are much surer methods by which accurate information on this point can be secured. In case there is any doubt as to the statement made by the applicant for employment, or if there is any other reason for giving his record more careful investigation, a letter is sent to the establishment which the workman has stated as being his previous place of employment. One of the forms which is most commonly used is shown below.

No. ------

—— STEEL CO.

----------------191--

GENTLEMEN: Mr------------------------------------makes application to this company for employment as--

He states that he was in your employ from------------------------------19-- to------------------------------19--, as------------------------------ under Mr--------------------------.

Any information you can give us will be appreciated and treated as confidential.

REPLY.

Occupation employed at--

His ability at that occupation--

Reason for leaving your employ--

Remarks: --

Thanking you in advance for a prompt reply, and assuring you of our willingness to reciprocate, we are,

Yours, very truly,

—— STEEL CO.,

------------------------------,
General Superintendent.

The elaborate system of index records of the character described above effectually prevents a workman from being reemployed by the same company if he has been discharged for any cause which, in the judgment of the company, makes him undesirable. The use of letters seeking information as to the employee's past record is that which is used in all lines of business and private employment, but it is none the less effective in preventing workmen who have given trouble in one company from securing employment elsewhere if their position is of such importance as to warrant the letter of inquiry being written. Such letters are not sent except where the workman is in a responsible position or where there is reason to doubt the statement which he had made to the employment bureau.

One of the large "independent" companies requires each employee to sign the following "Conditions of employment," in which all union affiliations are specifically denied by the applicant:

Stub:

CONDITIONS OF EMPLOYMENT OF THE ——— STEEL CO.

Employees of this company receive pay only on the regular pay day of each month. To persons leaving the service of the company, certificates of time are given under the following conditions only, viz: Seven days' notice having been given to either the foreman of the department in which the employee works, or to the timekeeper and worked out, or the employee having been discharged for any cause. Employees are hereby reminded of the necessity of giving their true and full name to the timekeeper.

....

General Superintendent.

Copy above delivered to ....

Formerly employed at ....

Now employed at ....

This is to certify that I am not now connected with any labor organization; and I further agree that while in the employ of "The ——— Steel Co.," I will not in any way, directly or indirectly, join, or have anything to do with any labor organization of any kind whatever. I also agree to comply to foregoing "Conditions of employment."

....

.........., ... 190...

....

Timekeeper.

Face:

CONDITIONS OF EMPLOYMENT OF THE ——— STEEL CO.

Name, ..., 190.. Dept. ....

.... *Timekeeper.*

Employees of this company receive pay only on the regular pay days of each month.

To persons leaving the service of the company, certificates of time are given under the following conditions only, viz:

Seven days' notice having been given to either the foreman of the department in which the employee works, or to the timekeeper and worked out, or the employee having been discharged for any cause.

Employees are hereby reminded of the necessity of giving their true and full name to the timekeeper.

....

General Superintendent.

THE "PETTY GRAFT" OF FOREMEN.

A condition which has long existed in the steel industry, and in other industries where the plants are large and the relations between the employers and the workmen are carried on largely through interpreters and foremen, is the exploitation of the more ignorant workmen by their foremen. This condition greatly complicates both the relation between the employers and the workmen and also between the different classes of workmen. It has arisen very largely through the employment of immigrants for the unskilled jobs.

The situation arises quite naturally because the immigrant, anxious for a position, is ready to pay for it liberally and, being ignorant of American customs and of the English language, he accepts without question the idea that it is only proper that he should pay something to the man that finds employment for him. In many cases the transaction is carried on through one of his own countrymen who zealously spreads the idea that work in the factory can be obtained only by paying the foreman a certain amount, usually from $5 to $10. Out of this sum, of course, a certain amount is deducted as a commission for the man who acts as "go-between," and the whole transaction is carried on without records of any kind and so quietly that it is almost impossible to secure any evidence of its having taken place. In many cases it is certain that the immigrant laborers voluntarily offer considerable sums to the foremen to secure jobs for them. All such transactions are carried on in such a secret manner that it is impossible to state even approximately how widespread the practice is, or even to speak with any degree of definiteness as to any phase of the situation. It is certain, however, that such practices have existed in many plants, and that some of the more unscrupulous foremen have exploited the workmen who come under their charge. A few cases have been brought to trial, but in no case, so far as is known, was the prosecution successful. In several establishments foremen and large numbers of workmen were discharged because they were under suspicion of having either given or accepted money in payment for special favors. It is by no means possible, however, to discharge a foreman every time that a charge is made against him, because such charges frequently are made by discharged employees or by workmen simply as a matter of revenge or spite, and various cases are known where seemingly good evidence was presented that a foreman was guilty, where it later developed that the entire matter had been arranged and the evidence manufactured in order to bring about the foreman's discharge.

The practices frequently take such forms that, except for the element of possible compulsion on the part of the foreman, they could scarcely be condemned. Small presents are given by the workmen at various times, the foreman is invited to the house to share in some special form of hospitality, or he is invited into a saloon to be treated by a number of his workmen. Such actions, of course, may be without any significance, but continued and regular practice of them is not likely unless there is some form of coercion.

One of the commonest forms in which the evil develops is that the foreman or some other petty official will borrow money from the men and never repay it. It is impossible in such cases to prove that the intention to repay was not genuine and that the whole transaction was not such as frequently takes place among men in other lines of employment. Another form which is frequently encountered is that where the foreman conducts a boarding house and where the men who work for him are supposed to live. In such cases prices higher than those paid elsewhere are charged and special prices are demanded for the food which the foreman in such places usually furnishes.

One of the most interesting cases encountered during the investigation was that of a foreign foreman who boarded about 25 of his countrymen, who were members of the gang of which he was boss. The foreman ostensibly ran a night school to teach the foreigners English and compelled all the men working under him to board with him and attend his night school, at the rate of $5 per month for two lessons a week. The case came to the notice of the company through the fact that it was at that time running a night school for teaching English, and though the fees connected with it were very much lower ($2 per month for three lessons per week) very few of the men attended the school. Upon inquiry the facts were discovered, and although it was judged that the situation did not justify dismissal for cause, as no actual taking of money without giving a return could be proved, the foreman was laid off a short time afterwards.

The superintendent of a comparatively large plant stated to one of the agents of the Bureau that he had been offered $40 per month by a saloon keeper of the town for the privilege of supplying the yard labor. At the same plant it had at one time been the practice of the foreman of the gas producers to cash checks for the men he employed and to keep all of the change less than $1 from the amount of each check. The foreman also made a practice of giving men employment in exchange for the payment of a certain sum which was to be taken out of the workman's pay in installments. One of the employees brought charges against the foreman in which he declared that he himself had paid the foreman $10 for the position he held. On investigation the officials of the company held that the charge was proved, and the foreman was accordingly discharged, besides being required to restore the $10 to the employee who had made the charge. Suit was brought, but was later nol-prossed through the impossibility of securing adequate evidence for court procedure.

The only effectual remedy against the sale of jobs by the foremen to the more ignorant workmen seems to lie in the establishment of central employment agencies under the control of a responsible and well-paid official. In the plants where such an employment office is thoroughly established and well managed no complaints of this character were found. Even an employment office does not in any way affect the possibility of a foreman demanding special payments from the workmen in return for keeping them employed after they have passed the employment office. The only adequate remedy for such conditions necessarily lies in the superintendent of the plant keeping in close touch with the conditions in each department of the works, having it thoroughly understood that any complaints of this character will be given the fullest and most impartial consideration, and that in case adequate proofs are furnished that any foreman is exploiting the workmen under him such a foreman will be discharged immediately. Court prosecutions in such cases are apparently without power to secure conviction, even when the evidence is very strong. Much of the difficulty experienced by superintendents in securing complaints from the workmen with regard to unjust treatment by the foremen undoubtedly arises out of the fact that so much restraint is placed upon the presentation of grievances by the employees.

RELATIONS OF EMPLOYERS AND UNION WORKMEN.

In spite of the present weakness in the Amalgamated Association it is none the less important to study briefly the character of its organization and its provisions for dealing with manufacturers. Many changes of considerable importance have been made in the organization and in the policies of the association within recent years, and it will therefore be necessary in some cases to describe the situation as it existed during the years of the union's greatest activity.

MEMBERSHIP OF UNION.

The chief characteristic of the Amalgamated Association during the whole period of strength and activity was its great exclusiveness in allowing only men in the more highly skilled occupations to become members. During the first five years of its existence as the Amalgamated Association the puddlers did not even allow their helpers to become members, and a large number of comparatively skilled occupations which had not been included in the unions which formed the amalgamation were not allowed to participate in the organization. In 1882, however, the constitution was so amended that men in practically all occupations involving any considerable skill were allowed to become members. The occupations were, however, definitely specified, and laborers were not allowed to become members under any circumstances. At this time blast-furnace employees were allowed to become members of the association only when the furnaces were operated directly in connection with steel works, and this rule has continued to exist, but within recent years no members of the association have been drawn from the blast-furnace department. In 1889 the list was extended to include "all men working in and around rolling mills, steel works, nail, tack, spike, bolt and nut factories, pipe mills, and all works run in connection with the same except laborers, the latter to be admitted at the discretion of the subordinate lodge to which application is made for membership."[1]

The exception allowing subordinate lodges to admit laborers at their discretion was virtually of no effect, and except occasionally, in times of industrial disputes, no laborers were admitted to the union. The rule remained unchanged up to 1910, when the wording of Article I, section 1, of the constitution was changed to read as follows:

SECTION 1. This association shall be known as the Amalgamated Association of Iron, Steel, and Tin Workers of North America, and shall be composed of all men working in and around rolling mills, tin mills, steel works, chain works, nail, tack, spike, bolt and nut factories, pipe mills, and all works run in connection with the same. Any person employed at any job controlled by this association shall be eligible to membership whether he be a stockholder or director.

This policy, it may be noted, was adopted near the end of the strike against the American Sheet & Tin Plate Co, and at the same time a special campaign was made to organize the unskilled laborers. The report of the committee appointed to formulate the plan for carrying on the campaign of organization is given in full as follows:[2]

To the officers and delegates assembled:

We, your committee, appointed to formulate a plan of organizing all unskilled laborers employed in and around all mills under our jurisdiction, beg leave to report the following:

1. That each sublodge appoint a committee of five (5) on organization; this committee be authorized to put into effect the purposes and intent of these recommendations.
2. All persons desiring to become members should be taken into the sublodge, where possible.
3. Where possible, the committee on organization should secure the services of foreign speakers to propagate the principles of our organization.
4. That application blanks, now printed in leaflet form, be printed in foreign languages in suitable quantity to supply all sublodges desiring them.

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[1] Constitution of Amalgamated Association, 1889, Art. I.

[2] Journal of the Proceedings of the National Lodge A. A. of I. S. and T. W. of North America, 1910, p. 8841.

5. When the executive board deems it necessary, literature of an educational nature should be published in foreign languages for the use of sublodges.

6. We recommend that the executive board grant special dispensation to all sublodges to reduce the initiation fee to $2.50 per member, where sublodges put into effect the purposes and intent of these recommendations.

7. That all persons joining the organization under the provisions of this plan shall be eligible to the sick and death benefit fund.

8. It is understood that in section 6 the plan of organization outlined above applies only to unskilled laborers. This does not include shearmen, straighteners, dragouts, firemen on furnaces, etc.

9. We would recommend that this plan of organization be sent to the sublodges as soon as possible, urging them to take up the work immediately.

JOHN MCGOVERN, *Chairman.*
AUSTIN OWENS, *Secretary.*
J. WILBURN,
F. DOHERTY,
J. O'NEAL,
C. A. JAMES,
D. O. DAVIS,
H. ALLINGTON,
J. LEYSHON,
H. IRVINE,
Committee.

Adopted by convention as a whole.

This plan consisted essentially in the provision of a special committee to carry on the work of organization, the admission of all persons to the privileges of the sick and death benefit fund, and the special dispensation allowing the initiation fee to be reduced to $2.50 per member. The regular initiation fee, as provided in the constitution, was to be "not less than $5." Monthly dues for the members had been graduated in proportion to the daily earnings since 1905. This was done only against the protest of a large number of the more highly paid workmen. Dues in 1910, at the time of beginning the campaign for extending the membership, were graduated as follows:

Members earning $2.50 per day or less, 60 cents per month dues.
Members earning over $2.50 per day and less than $5, 80 cents per month dues.
Members earning $5 and upward per day, $1 per month dues.

In addition, special dues of 25 cents per month are collected for the benefit fund.[1]

In accordance with this general plan a campaign was undertaken, and a number of organizers were put in the field. They were, however, able to accomplish little, and up to the present time very few laborers or other unskilled employees have been admitted to the union. The old restrictions have, however, been removed, and the machinery now exists by means of which this class of employees may be included in the union.

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[1] Constitution, Amalgamated Association, Art. XXIX.

METHOD OF FIXING WAGE SCALES.

The chief purpose of every labor organization is concerned with securing and maintaining the best obtainable scale of wages. The scale of the Amalgamated Association is unusually complex, owing to the large number of different products included in the branches in which it exists. In order to give both the manufacturers and the union a chance to formulate and pass upon the scale each year a very elaborate procedure is necessary. The exact method of procedure is shown in detail in Article XXII of the constitution. Briefly stated, the procedure is as follows:

All notices of changes in the scale must be sent to the national secretary before the third Tuesday in March. These proposals are then compiled and printed and a copy is sent to each of the subordinate lodges in order that they may be discussed and the delegates sent to the convention may be properly instructed. From among the delegates of the various lodges the president of the association appoints a wage committee, which meets a few days before the opening of the convention, formulates a scale to be presented for the approval of the convention, and also makes specific recommendations regarding each of the proposals that have been made for changes. The convention is usually held early in May in order to give sufficient time for complete discussion before the conference with the manufacturers, which takes place some time during June. The report of the wage committee is presented to the convention and each item is voted upon separately, being subject to amendment or complete revision at the hands of the convention. The so-called western scale of prices, the only one which now exists, is considered by a conference between the Western Bar Iron Association, the Republic Iron & Steel Co., and representatives of the Amalgamated Association. The conference committee of the association is given full power to modify the scale adopted by the convention, and as a consequence, unless there are unusual changes or considerable demands are made by one side or the other, arrangements for the new scale are usually made without great difficulty. In 1910 the Amalgamated Association and the manufacturers who are organized in the Western Bar Iron Association adopted the so-called continuous-operation agreement which provides, in brief, for the continuous operation of the plants under the old scale in case the two parties fail to reach an agreement, and also provides a specific plan of conciliation in case no settlement can be reached between the representatives of the two parties. This agreement is as follows:

CONTINUOUS-OPERATION AGREEMENT.

1. A yearly scale shall be presented to the Western Bar Iron Association by the Amalgamated Association of Iron, Steel, and Tin Workers, not later than June 1 of each year; but the Western Bar Iron Association may, at its discre-

tion, prepare and present a scale to the Amalgamated Association for consideration by its wage committee and convention.

2. It is agreed that a joint conference shall be held between the Western Bar Iron Association and representatives of the Amalgamated Association as soon as possible after the Amalgamated Association scale has been presented, at which time both scales shall be discussed, and an effort made to arrange a scale suitable to both parties. Negotiations to that end shall continue if necessary to August 1, when they will terminate, except by mutual consent to their continuance by the respective conference committees.

3. Pending negotiations there shall be no cessation of work by the members of the Amalgamated Association, during which time the scale of the previous year shall remain in full force and effect.

4. It is further agreed that all men working under any of the provisions of the scale of wages, negotiated under this agreement, should be members in good standing of the Amalgamated Association of Iron, Steel, and Tin Workers. The manufacturers composing the Western Bar Iron Association agree to cooperate with the Amalgamated Association to bring about this result.

5. It is further agreed that either party to this agreement may call for a conference at any time between January 1 and March 15 of any year after 1910 to make such change as may be mutually agreed upon. At such conference this agreement may be abrogated at the will of either party.

It will be noted that this agreement differs from the one previously in effect with the bar iron manufacturers, in that the provision for a board of conciliation has been eliminated and a provision inserted that makes it easy to get all men governed by our scale and this agreement into the organization if dealt with properly by the lodge having jurisdiction.[1]

The Republic Iron & Steel Co. does not operate under this continuous-operation agreement, believing the other method to be rather to its interest.

THE SLIDING SCALE.

The feature of greatest importance in the agreements between the Amalgamated Association and the manufacturers is the sliding scale of wages. This method of determining wages according to the selling price of the product has such great theoretical advantages and has generally worked so well in the iron and steel industry that some discussion of it will be of interest. The sliding scale was developed in connection with the puddling mills, where the wide fluctuations in the price of wrought iron gave it a peculiar significance. The sliding scale as it exists in the steel industry has two principal features: (1) That wages shall advance and decline uniformly with the rise and fall of prices of the finished product, and (2) that there shall be a minimum rate below which wages shall not fall, no matter how low the selling price of the finished product may be. The scale, as signed in 1911, provides that when bar iron is sold at a price of 1 cent per pound the wages paid for puddling for the two following months shall be $5 per gross ton of 2,240 pounds. It is provided that with each advance of five-hundredths of 1 cent in price of bar iron the rate paid per ton shall advance 12½ cents. If bar iron should rise in price to 2 cents a pound the price paid for puddling would be $7.50 per ton. During 1910 the average price of bar iron ranged between 1.3 and 1.4 cents per pound. Consequently, the price paid for puddling varied between $5.75 and $6 per ton.

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[1] Journal of Proceedings, National Lodge Amalgamated Association, 1910, p. 8850.

At no time since 1905 has the price paid for bar iron been as low as the base price of the scale, but it has happened in other lines of production that the price of the finished product has been considerably below the base price of the scale. Wherever this condition has continued for any long period it has inevitably resulted in causing the manufacturers to feel a great deal of opposition toward the sliding scale with the fixed base price. This was one of the causes of irritation which resulted in making the Carnegie Co. an enemy of the Amalgamated Association. After the Homestead strike of 1889 the scale for the steel mills was based upon $25 as the minimum price. This scale was signed for a period of three years. During the first six months of this period steel billets sold considerably above the base price. For the greater part of the remaining two and a half years, however, they were priced well below $25 and for a part of the time sold at $23. During a large part of the three-year period, therefore, the Carnegie Co. was paying wages on the basis of $25 per ton for steel billets when the billets were selling for much less. In 1892, at the termination of the above agreement, it was proposed that the base should be greatly reduced so that it should be well below the price at which billets had been selling. This proposal was one of the main points of controversy in the Homestead strike of 1892. In the case of tin plates the base price per box of 100 pounds for the last few years has been $3.90, but the average wholesale price, as reported by the American Iron and Steel Association, has not been as high as $3.90 during either 1908, 1909, or 1910, and was just $3.90 in 1907. In this particular branch of the industry, therefore, the sliding scale within recent years has lost its peculiar significance.

ATTITUDE TOWARD NONUNION WORKMEN.

The Amalgamated Association, owing to the peculiar character of its membership, has never specifically insisted upon the principle of the "closed shop" in its agreement with manufacturers. At the same time two of its policies have resulted virtually in securing the full effect of closed-shop agreements. The first of these is the constitutional provision that all mills under the jurisdiction of the Amalgamated Association shall be organized in all departments for which scales are provided.[1] Second, the policy which was maintained even after the strike of 1901 is that no member shall work with nonunion men in an occupation embraced by the scales of the organization. For example, in 1902, the president of the Amalgamated Association, referring to the clause in the agreement with the American Sheet & Tin Plate Co., reserving to the company the right to discharge any employee for preventing another from peaceably following his vocation, wrote as follows in his annual report:

> This clause means that the company can discharge any man who interferes with another because he is a nonunion man. It does not mean that our members are compelled to work with him. I have ruled that we hold the right we always had of refusing to work with any man who is obnoxious to us. Some lodges accepted my ruling and refused to work with certain men and had them discharged, or compelled them to keep in good standing in the lodge.[2]

The president of the association, in a special communication to the Bureau with regard to this policy, writes as follows:

> Wherever practicable, steps are taken to provide a scale of prices for every trade or calling within the jurisdiction of the organization. The constitution provides that all mills under our jurisdiction be organized in all departments. We insist, for example, that where puddlers are employed and are members of the union that the roll hands shall also be members of the union. We believe that all men employed in union mills should interest themselves, individually and collectively, in protecting their trade and the business of all employers who recognize, negotiate, and who enter into trade agreements with the association. To this end we use moral suasion with all men to have them affiliate with the organization. In this we seek the cooperation of the employers with whom we have trade agreements, and while our men have the right to refuse to work with men who are not members, the influence of employers and representatives of the organization are exerted in a peaceful way to establish discipline in the plant.
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> We believe that better results can be obtained in this way than by a peremptory demand on the men through the medium of the organization.

In addition to the scale of wages the joint agreements signed by the manufacturers and the Amalgamated Association include a large number of points relative to the working conditions to be maintained in the plants affected by the agreement. These special provisions relate to three principal subjects: (1) The prohibition of the more highly skilled employees who are members of the association from performing various tasks for which it is held that the company should provide. For example, in the tin-plate mills there are special fines to be imposed upon any member of the roll crew who shall change rolls or other castings or clean grease or assist in any part of such work. The fine is unusually heavy, amounting to $5 or more for the first offense and expulsion from the association in case of repetition. Similar rules exist in practically every branch of the industry for which the scale provides. (2) Rules providing for the length of the working day. (3) Rules governing the limitation of output. During the early years of the Amalgamated Association rules governing production existed in every branch of the industry and a large part of the time of the national office and the local lodges was occupied in enforcing them, as they were frequently broken by the members of the association. The greatest stress continued to be laid upon this feature, however, for a long period; but one by one the restrictions were eliminated through the opposition of the manufacturers and of the men in the mills which were capable of producing a larger product than the union rules allowed.

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[1] Art. XVII, sec. 5. No person shall work at a scale job or constitutional job in any mill signing the Amalgamated Association scale who refuses to become a member of the Amalgamated Association and pay all fines, dues, and assessments levied by same, and any member using his influence to disorganize his fellow workmen or knowingly makes it difficult to carry out the objects of the Amalgamated Association shall be tried as per Art. XIV, sec. 2.

[2] Journal of Proceedings, National Lodge Amalgamated Association, 1902, p. 6320.

These restrictions were never as stringent as they have been in foreign countries; but in an industry developing with the rapidity which characterized the steel industry during this period and with a group of employers whose principal object was to increase the output at any cost, such restrictions more than anything else served as a source of constant irritation, and were the cause of the most strenuous opposition on the part of the manufacturers and the engineers concerned in developing the machinery and equipment of the plant to secure larger results. Practically all restrictions have now been eliminated, except with regard to the number of heats to be worked in puddling mills, which have never been of any great significance, since the amount of production is practically limited by the nature of the process.

CHAPTER V.

PLANS FOR ELIMINATING THE 7-DAY WEEK AND THE 12-HOUR DAY: RESULTS AND COSTS.

CHAPTER V.

PLANS FOR ELIMINATING THE 7-DAY WEEK AND THE 12-HOUR DAY: RESULTS AND COSTS.

INTRODUCTION.

The labor problem of the greatest immediate importance in the iron and steel industry is the schedule of working hours. This has been recognized in the recent discussions of working conditions in the industry both by the manufacturers themselves through the activities of the American Iron and Steel Institute and by the outside critics of the industry. In Volume I of this series a detailed statement and analysis of the hours of labor existing in the steel industry in 1910 was made. The purpose of the present chapter is to discuss the changes which have been made in working hours since that time and to consider as fully as possible the proposals which have been made for further changes.

WORKING HOURS IN 1912.[1]

For the greater part of the workmen in the iron and steel industry the condition as regards working time may be briefly stated as the combination of a schedule of unusually long hours of labor with an alternation of day and night work and with frequent extended periods of overtime. Approximately one-half of the employees in the iron and steel industry have a regular working-day of 12 hours, usually from 6 a. m. to 6 p. m. when on the day shift and from 6 p. m. to 6 a. m. when on the night shift. Every week or two weeks practically all of these 12-hour workmen change from the day shift to the night shift, or vice versa, and must consequently accustom themselves to the changed conditions of eating and sleeping. Apart from the difficulty of making this periodic readjustment of habits, to which all of the workmen interviewed testified, there is in the case of the married employees the added hardship of almost complete separation from their wives and children. Furthermore, at the end of the 12-hour day, whether on the day shift or the night shift, the workmen are, as is shown elsewhere, liable to be called upon to work 12 hours more in place of absent workmen, or to work for several hours until some repair job is completed. Many cases were encountered in the investigation where workmen were on duty continuously for 36 hours, often without an hour's sleep or rest and sometimes without even hot food.[1] Moreover, a large number of the employees work every day in the week, including Sunday, and, at the time the shifts are changed from day to night, these workmen are on duty continuously for either 18 or 24 hours. In May, 1910, 30 per cent of the employees worked 7 days a week, but during the past year (1911–12) a number of companies have made such arrangements that none of their employees is permitted to work more than 6 days per week. Between 40 and 50 per cent of the employees formerly working 7 days per week have been affected by these arrangements for 6-day work, but this still (August, 1912) leaves more than 15 per cent of the employees in the industry generally and more than 50 per cent of the blast-furnace workmen on a regular schedule of 7 days a week with a long turn of 18 or 24 hours at the change of shift.

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[1] In order to give a complete idea of the existing system of working hours in the large plants, a detailed exhibit of the hours of labor in a representative steel plant of the Pittsburgh district is presented in Appendix G. This exhibit will be of great value to anyone desiring to make a detailed study of the question of working hours.

Such a schedule of working hours is now recognized by the leading steel manufacturers and the public, as well as by the workmen, to be undesirable socially and productive of industrial inefficiency. The 7-day week has been particularly condemned and certain steps for its elimination have already been taken. The 12-hour day has likewise come to be regarded as undesirable and certain definite recommendations for its abolition have been made. The nature of these changes and recommendations, their probable effectiveness in securing the desired results, and the cost of putting them into effect will be considered in this chapter. As the question of overtime has heretofore received little public attention a separate chapter is devoted to a consideration of the causes and extent of overtime in the industry.

During the past year (1911–12) the hours of labor in the steel industry as described above have been considered by two important and independent bodies: (1) The stockholders' committee of the United States Steel Corporation; (2) the Special Commission on Hours of Labor in Continuous Industries appointed in accordance with resolutions adopted by the Sixth Delegates' Meeting of the

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[1] The overtime work is not limited to the producing departments, but extends to the officials and to the clerical force. An extreme instance of this kind may be cited. At the time of one of the important consolidations the chief clerk of a large steel plant remained at his desk for 38 hours without sleep, eating irregularly what was brought him. As a consequence of the overstrain he has been unable to work by artificial light since that time.

International Association for Labor Legislation at Lugano in 1910. Both of these bodies have made reports with definite recommendations for the shortening of the hours of labor in the steel industry.

REPORT OF COMMITTEE OF STOCKHOLDERS OF THE UNITED STATES STEEL CORPORATION.

The committee of stockholders of the United States Steel Corporation, consisting of five prominent stockholders, submitted a report in April, 1912, containing the following statements and recommendations:

> Whether viewed from a physical, social, or moral point of view, we believe the 7-day week is detrimental to those engaged in it. While not wishing to imply that the method adopted by any individual official or any combination of two or more methods would be the best to meet requirements in all mills, we are strongly of the opinion that no matter what alleged difficulties in operation may seem to hinder the abandonment of the 7-day week, they must be met.
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> * * * * * * *
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> Closely allied with the question of the 7-day week is that of the excessive hours of labor involved in continuous processes, caused by the changing of the working shifts from day turn to night turn and vice versa. An examination of the time sheets of many of the mills shows that this practice has been entirely abolished in many of the departments and not in others. We recognize that at rare intervals there may come emergencies and unusual conditions that would make absolute enforcement of any exact schedule of work hours impracticable, a fact equally true in any field of industry and commerce. Our investigation, however, leads us to believe that it is feasible and practicable to eliminate the long turn formerly followed in the changing of shifts in continuous-process work and that it should be done. Further, that conscientious effort should be made by all to reduce to a positive minimum any undue length in work hours that emergencies and unforeseen conditions may sometimes demand.
>
> The actual physical labor involved in many of the positions is to-day much less than in former years, this being especially true of the open-hearth and blast furnaces, where the intermittent character of the work is such that there is less call for actual expenditure of physical energy than in many of the 8 and 10 hour positions.
>
> Notwithstanding this fact, we are of the opinion that a 12-hour day of labor followed continuously by any group of men for any considerable number of years means a decreasing of the efficiency and lessening of the vigor and virility of such men.
>
> The question should be considered from a social as well as a physical point of view. When it is remembered that the 12 hours a day to the man in the mills means approximately 13 hours away from his home and family—not for one day, but for all working days—it leaves but scant time for self-improvement, for companionship with his family, for recreation and leisure. It is important that any

industry be considered in its relation to the home life of those engaged in it, as to whether it tends to weaken or strengthen the normalness and stability of family life. By a reasonable conserving of the strength of the working population of to-day may we be best assured of a healthy, intelligent, productive citizenship in the future.

* * * * * * *

That steps should be taken now that shall have for their purpose and end a reasonable and just arrangement to all concerned of the problems involved in this question—that of reducing the long hours of labor—we would respectfully recommend to the intelligent and thoughtful consideration of the proper officers of the corporation.

RESOLUTIONS OF THE FINANCE COMMITTEE OF THE UNITED STATES STEEL CORPORATION.

Upon the basis of these recommendations of the stockholders' committee the finance committee of the Steel Corporation in May, 1912, passed the following resolutions, calling attention to the fact that as long ago as April, 1907, they had recommended the elimination of 7-day labor:[1]

Resolved, That in accordance with the spirit of the resolution adopted by this committee on April 23, 1907, 7-day labor should be eliminated in all mines, mills, shops, railways, docks and works of the Steel Corporation, except under special circumstances and then only upon the consent of this committee.

Resolved, That the so-called long turn, formerly followed in the change of shifts in continuous-process work, should be eliminated or reduced in all cases where it now continues among employees of the subsidiary companies, except under special circumstances and then only upon the consent of this committee.

Resolved, That conscientious effort should be made by all to reduce to a minimum any unusual length in work hours that emergencies and unforeseen conditions may sometimes demand.

Resolved, That copies of these resolutions be sent to the presidents of all the subsidiary companies with the recommendation that all operating officials be governed accordingly.

Resolved, That the chairman, Mr. Roberts, and the president of the corporation be appointed a committee to consider what, if any, arrangement with a view to reducing the 12-hour day, in so far as it now exists among the employees of the subsidiary companies, is reasonable, just and practicable.

RESOLUTIONS OF THE SPECIAL COMMISSION ON HOURS OF LABOR IN CONTINUOUS INDUSTRIES.

The Special Commission on Hours of Labor in Continuous Industries consisted of representatives of Great Britain, Germany, France, the United States, and nine other countries, the representatives in most cases being officially appointed by their respective Governments. At the invitation of the British section of the International Association for Labor Legislation, the commission met in London, June 11 and 12, 1912. The purpose of this meeting was to initiate an international agreement with regard to the hours of labor in continuous industries, such as the iron and steel industry, so that the establishments which reduced the hours of labor would not be subject to detrimental international competition with establishments which maintained a long schedule of working hours. The commission passed the following resolutions, which were presented to the Seventh Delegates' Meeting of the International Association for Labor Legislation, at Zurich, in September, 1912:

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[1] See p. 165 for this recommendation.

> (*a*) In view of the facts which have been placed before the commission, we are of opinion that the eight-hour shift in continuous industries (industries working night and day) is the best shift system for such work, and should be strongly recommended, both from the point of view of the physical and moral welfare of the workers and in the social and economic interests of society generally.
>
> (*b*) The special reports presented by the different national sections have shown that in the iron and steel industries the eight-hour day is very necessary, and is practicable.
>
> (*c*) The commission asks the International Association to address to the Governments as soon as possible the request to arrange a conference of the interested States, with a view to arriving at an international agreement as to the introduction of the eight-hour day in these industries.[1]

Both the international commission and the stockholders' committee of the Steel Corporation condemned the 12-hour day as well as the 7-day week. The international commission definitely recommended the substitution of the 8-hour day for the 12-hour day, while the stockholders' committee merely recommended "a reasonable and just arrangement * * * of reducing the long hours of labor." As a matter of fact the recommendations are identical in effect, since in the productive occupations of the industry there is no alternative for the 12-hour day except three shifts of 8 hours each. This is due to the fact that the blast furnaces, steel works, and rolling mills are operated continuously throughout the full 24 hours of the day. Two or more shifts of workmen are therefore required, and an equable division of the working time between the shifts demands that each shift shall work either 8 hours or 12 hours.[1] A brief statement of the reasons for the continuous operation of the various departments is given in the following section.

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[1] In connection with these resolutions the Seventh Delegates' Meeting of the International Association adopted the following:

I. In view of the resolutions of the Lugano meeting and of the facts presented to the special commission in London, the delegates' meeting is of opinion that the eight-hour shift in continuous industries (industries working night and day) is the best shift system for such work and should be strongly recommended, both from the point of view of the physical and moral welfare of the workers and in the social and economic interest of society generally.

II. The delegates' meeting is of opinion that the reports presented by the different national sections have shown that in the iron and steel industries (blast furnaces, iron and steel works, rolling mills) the eight-hour day is very necessary and is practicable for the shift workers. The meeting instructs the bureau to request the Swiss Federal Council to address to the Governments as soon as possible the request to arrange a conference of the interested States, with a view to arriving at an international agreement as to the introduction of the eight-hour day for those workers.

REASONS FOR CONTINUOUS OPERATION.

Continuous operation, which is now such a striking feature of the iron and steel industry, is in part due to technical necessity and in part to economic motives of greater or less weight. Briefly stated, the situation is as follows:

1. In the blast-furnace department there are strong technical reasons for continuous operation not only night and day but also 7 days a week. Any long interruption of operations, unless very elaborate preparations for "banking" are made, is not only detrimental to the product but may result in serious injury to the furnace. A few blast furnace managers believe that the periodical banking of furnaces is possible and even practicable, but the weight of opinion is against them and the few experiments made have not been encouraging. Even if technically possible, the process of banking as often as once a week requires the unproductive burning of such tremendous quantities of coke that it is unlikely that such a method is commercially profitable.

2. In the steel works and rolling mills continuous day and night operation is demanded on technical grounds which, however, do not so forcibly apply to 7-day operation. This is so for the following reasons: After a stoppage of operation the equipment and metal becomes cold, and, in beginning again, several hours' preliminary work is required before normal efficiency is attained. As a result it is impracticable to shut down each night. The Sunday stoppage, however, does not result in such a loss, because extensive overhauling and repairs must be made at frequent intervals, and such repairs can be made so much more efficiently during a period of stoppage that the evtra work of resuming operation and the heat that is lost in bringing the furnace, rolls, and metal to a working temperature are more than compensated for.

3. In the other departments—yard, transportation, etc.—there are no technical reasons of any sort for continuous operation.

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[1] Such a division of time as 10 hours for the day shift and 14 hours for the night shift is, of course, possible, but in any case the working hours of the different shifts must average either 12 or 8 hours.

4. In most kinds of factory work there is a certain economy in operating as continuously as possible, because of the return thereby secured from the machinery and other fixed capital. The saving is most evident in "rush" seasons, when by increasing the hours of operation an increased output can be secured with the same plant equipment. This economic motive for continuous operation is particularly strong in the iron and steel industry, because of the industry's large capitalization in proportion to the value of its product.

As a result of these considerations many iron and steel manufacturers and managers, in their desire for immediate low operating costs, gradually came to operate their plants or departments day and night during as great a part of the week as the condition of the physical equipment would allow. According to the testimony of officials and workmen conditions were at their worst during the "boom" of 1906 and 1907, when it was a common thing for every department of a large steel plant—blast furnaces, steel works, and rolling mills, as well as the repair departments and shops—to operate on Sunday as briskly as on any other day of the week.

The harmful effects of such a system of operation became so evident that on April 23, 1907, the finance committee of the Steel Corporation passed the following resolution:

> On motion, it was voted to recommend to all subsidiary companies that Sunday labor be reduced to the minimum; that all work (excepting such repair work as can not be done while operating) be suspended on Sunday at all steel works, rolling mills, shops, quarries, and docks; that there shall be no construction work, loading or unloading of materials.
>
> It is understood that it is not at present practicable to apply the recommendation to all departments, notably the blast furnaces, but it is desirable that the spirit of the recommendation be observed to the fullest extent within reason.

This resolution was somewhat indefinite in its instructions, but for a time at least resulted in the suspension of productive work in most of the steel works and rolling mills of the Steel Corporation from Saturday afternoon till Sunday afternoon. So far as could be ascertained none of the other companies, with the exception of one small blast-furnace plant, took any action with regard to the matter.

During the autumn of 1907 occurred a great depression in the iron and steel industry. During this period, because of the slack demand, none of the steel works and rolling mills was operated for 7 days a week. The blast furnaces alone operated continuously through the week, and as there was a superabundance of labor, any man who wanted to lay off one day a week could easily secure permission. With all the departments running at low pressure little repair work was necessary which could not be done without Sunday work.

During the latter half of 1909 the demand for steel products developed rapidly, and by November of that year practically every plant in the country was being operated to its full capacity in an attempt to fill the rush of orders. Seven-day operation of steel works and rolling mills was common, and practically every plant started operations for the week on Sunday afternoon. This applied to the plants of the Steel Corporation as well as to other companies, for in the rush of business the resolution of the finance committee regarding Sunday work was forgotten.

PLANS FOR THE ELIMINATION OF 7-DAY WORK.

Public attention was directed to the prevalence of seven-day work in the iron and steel industry by the strike at the Bethlehem Steel Works in February, 1910. In its investigation of this strike the Bureau of Labor found that practically the entire Bethlehem plant (shops, rolling mills, and steel plant, as well as blast furnaces) was operating on a seven-day basis, Sundays being like other days.[1] This had started during the rush of work in the fall of 1909 and had grown worse with the continuance of the great demand for the plant's products. This was by no means an exceptional situation, for the present investigation, in which were examined the pay rolls of May, 1910, after the rush of business had somewhat subsided, found a number of plants in which steel works and rolling mills as well as most of the shops were operating on a seven-day basis. Furthermore, as is shown in Chapter VI, in many of these plants excessive overtime was almost as common as in the Bethlehem Steel Works.

On March 21, 1910, the following telegram was sent by the chairman to the presidents of all the subsidiary companies of the Steel Corporation:

> NEW YORK, *March 21, 1910.*
>
> Mr. Corey, Mr. Dickson, and I have lately given much serious thought to the subject matter of resolution passed by the finance committee April 23, 1907, concerning Sunday or seventh-day labor. Mr. Corey has written you on the subject within a day or two. The object of this telegram is to say that all of us expect and insist that hereafter the spirit of the resolution will be observed and carried into effect. There should and must be no unnecessary deviation without first taking up the question with our finance committee and asking for a change of the views of the committee, which probably will not, under any circumstances, be secured. I emphasize the fact that there should be at least 24 continuous hours' interval during each week in the production of ingots.
>
> E. H. GARY.

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[1] Report on Strike at Bethlehem Steel Works, South Bethlehem, Pa., S. Doc. No. 521, 61st Cong., 2d sess., 1910.

This telegram ordered that the production of ingots should cease during a period of at least 24 hours per week, and emphasized the instruction contained in the resolution of April 23, 1907, that no construction or shipping should be performed on Sunday. It did not, however, affect the operation of blast furnaces.

A committee of the American Iron and Steel Institute was appointed during May to consider what plans might be devised by which it would be possible to insure that each blast-furnace employee should have at least one day of rest each week, and also to make such arrangements that the long turn of 24 hours at the time of changing shifts would not be necessary. After a long investigation the following plan was devised by the committee:

PLAN RECOMMENDED BY THE AMERICAN IRON AND STEEL INSTITUTE CHANGING THE SEVEN-DAY WEEK TO ONE OF SIX DAYS AND ABOLISHING THE LONG TURN OF TWENTY-FOUR HOURS OR EIGHTEEN HOURS IN CHANGING FROM DAY TURN TO NIGHT TURN.

Turn.	First week.							Second week.							Third week.							Fourth week.						
	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Day....	2	A	1	1	1	1	1	1	A	1	1	1	1	1	1	B	2	2	2	2	2	2	B	2	2	2	2	2
Night..	1	B	2	2	2	2	2	2	B	2	2	2	2	2	2	A	1	1	1	1	1	1	A	1	1	1	1	1
Day....	4	4	A	3	3	3	3	3	3	A	3	3	3	3	3	3	B	4	4	4	4	4	4	B	4	4	4	4
Night..	3	3	B	4	4	4	4	4	4	B	4	4	4	4	4	4	A	3	3	3	3	3	3	A	3	3	3	3
Day....	6	6	6	A	5	5	5	5	5	5	A	5	5	5	5	5	5	B	6	6	6	6	6	6	B	6	6	6
Night..	5	5	5	B	6	6	6	6	6	6	B	6	6	6	6	6	6	A	5	5	5	5	5	5	A	5	5	5
Day....	8	8	8	8	A	7	7	7	7	7	7	A	7	7	7	7	7	7	B	8	8	8	8	8	8	B	8	8
Night..	7	7	7	7	B	8	8	8	8	8	8	B	8	8	8	8	8	8	A	7	7	7	7	7	7	A	7	7
Day....	10	10	10	10	10	A	9	9	9	9	9	9	A	9	9	9	9	9	9	B	10	10	10	10	10	10	B	10
Night..	9	9	9	9	9	B	10	10	10	10	10	10	B	10	10	10	10	10	10	A	9	9	9	9	9	9	A	9
Day....	12	12	12	12	12	12	A	11	11	11	11	11	11	A	11	11	11	11	11	11	B	12	12	12	12	12	12	B
Night..	11	11	11	11	11	11	B	12	12	12	12	12	12	B	12	12	12	12	12	12	A	11	11	11	11	11	11	A

Numbers 1 to 12 represent a crew of present employees.

Letters "A" and "B" represent additional men who serve to relieve each of the 12 employees on one day each week.

Each employee, including the relief men, works each week 6 turns of 12 consecutive hours.

In changing shifts every two weeks from day to night turn and vice versa, the crew as a whole does not change but each pair of men (e. g. Nos. 1 and 2) change shifts in the day following their day off. Each man, therefore, works alternately 12 turns day and 12 turns night, with a rest of 24 hours between the changes of shift.

Each man's rest day remains the same throughout the year (e. g., Nos. 1 and 2 always rest on Monday). Relief men "A" and "B" always have Sunday off in order to relieve the regular crews on duty Sundays.

All men are treated exactly alike as to time off, hours worked, change from day to night turn, etc., except that the weekly day off is different for each man in every group of seven.

The adoption of this plan or some similar plan in the operation of blast furnaces was recommended by the American Iron and Steel Institute, and efforts were made to induce a large number of companies to put the plans into effect. The results of these efforts are shown in the following table, which is based upon information secured from the companies by the Bureau of Labor in February and March, 1912. All blast-furnace plants in which any plan for the elimination of 7-day work was in effect on or before February, 1912, are classified as having "improved conditions."

PER CENT OF EMPLOYEES WHO ARE IN BLAST-FURNACE PLANTS AFFECTED BY PLANS FOR ELIMINATION OF SEVEN-DAY WORK, FEBRUARY, 1912.

	Number of employees.	Per cent.	
		Conditions improved.	Conditions unchanged.
United States Steel Corporation	9,801	(1)	....
Large independent companies	6,951	21.3	78.7
Small companies	16,225	16.8	83.2
All companies	32,977	42.5	57.5

[1] In all but one of the plants the plans have eliminated 7-day work for all but a very few employees. In the excepted plant the plan for the elimination of 7-day work has not been completely introduced; 28 per cent of the blast-furnace employees in this plant work 7 days per week as compared with 55 per cent before the introduction of the plan.

By the adoption of the plan of the institute or some similar plan conditions were improved in plants employing 42.5 per cent of all blast furnace employees.

The plan was generally adopted by the Steel Corporation, every blast furnace plant owned by the corporation having greatly reduced the proportion of men working on a 7-day schedule prior to March, 1912. In one of the plants, on account of local conditions, it was found possible to reduce the amount of Sunday labor by only one-half, so that 28 per cent of the blast furnace employees still work on a 7-day schedule, but in the other blast furnaces the plans were so completely introduced as practically to abolish 7-day work.

Conditions as regards 7-day work were improved to a slightly greater extent in the blast furnace plants of the large independent companies than in those of the small companies. In both groups of companies, however, the proportion of men affected by the improved conditions is small.

The character of the plans put into effect in the different groups of companies and the number of plants and employees affected thereby are shown in the following table. In one of the plants conditions have been improved by the introduction of the 8-hour system of operation with three shifts of workmen. This system does not do away with 7-day work, but it so completely eliminates the evils incident to 7-day labor for 12 hours a day that it is properly included in the table.

NUMBER OF BLAST-FURNACE PLANTS AND EMPLOYEES AFFECTED BY INTRODUCTION OF PLANS FOR THE ELIMINATION OF SEVEN-DAY WORK, FEBRUARY, 1912, BY GROUPS OF COMPANIES.

	United States Steel Corporation.		Large independent companies.		Small companies.		Total.	
	Number of plants.	Number of employees.	Number of plants.	Number of employees.	Number of plants.	Number of employees.	Number of plants.	Number of employees.
Conditions improved:								
I. Definite plan for elimination of seven-day work—								
a. Without any long turn..	[1] 20	[1] 7,291	1	193	[2] 4	[2] 1,348	25	8,832
b. With a long turn of 18 hours..................	4	1,173	....	....	1	231	5	1,404
c. With a long turn of 24 hours..................	3	1,337	....	....	....	....	3	1,337
II. Eight-hour day..............	....	....	1	767	....	....	1	767
III. Each workman required to rest one day each week and arrangements made to fill his place..............................	....	....	1	523	5	1,154	6	1,677
Total..............................	27	9,801	3	1,483	10	2,733	40	14,017
Conditions unchanged:								
I. Nothing done..................	....	....	12	4,882	[3] 73	[3] 9,968	85	14,850
II. Out of blast	....	....	1	102	19	2,046	20	2,148
III. Inquiries unanswered [4]......	....	....	1	484	10	1,478	11	1,962
Total..............................	....	....	14	5,468	102	13,492	116	18,960

[1] Including one plant with 478 blast-furnace employees, in which the plan had not been completely introduced; 28 per cent of the blast-furnace employees in this plant work 7 days per week as against 55 per cent before the introduction of the plan.

[2] Including one plant with 122 employees, in which a plan giving employees 4 days off each month with full wages for 2 of the rest days was abandoned on account of employees' opposition.

[3] Including 10 plants with 1,422 employees, in which plan was not introduced because of adverse vote of employees.

[4] The companies which did not reply to the inquiries are classified under "Conditions unchanged" because in the case of all but one of these companies it is known positively that nothing has been done to improve conditions.

The plans most generally adopted were similar to the plan proposed by the American Iron and Steel Institute, which provided for the abolition of the "long turn" at the change of shifts. There were, however, eight large plants in which the plans adopted did not do away with the long turn. To these eight plants should be added the six plants in which no systematic plan was adopted, each man being required to take one day off each week, and in which the long turn continued to be worked when the shifts changed. In Appendix H a number of the plans adopted by various plants are shown, so that it is not necessary to discuss them here. It may be noted, however, that one company with 767 blast-furnace employees has adopted the eight-hour day for its blast furnaces. This plan is fully discussed later in this chapter.

It is necessary, in order that the later discussion may be clearly understood, to point out that none of the plans involved any added cost to the steel companies. Much inconvenience and a great deal of careful planning was involved in introducing these plans, but the actual operation of the plans did not cost the steel companies anything. Extra men were required to relieve the regular crews, but in every case they were paid the wages of the men they replaced. That is, if relief man "A" takes the place of " B " on the regular crew on Sunday, he simply receives the wages that " B " would have earned if he had worked. It is of course a matter of indifference to the company whether the wages for the Sunday's work is paid to "A" or to " B," since the total amount paid out is the same.

Practically every blast-furnace plant introducing one of the plans requiring the workmen to rest one day in seven reports the workmen as dissatisfied with its results and generally opposed to it. Every plant in which the plan adopted allowed the continuance of the long turn reports dissatisfaction among the employees. The abolition of the long turn of 18 or 24 hours at shift changes appears from the reports to be the only feature which the workmen like.

The dissatisfaction with the various plans for eliminating 7-day work has two principal causes. First, and most important, is the loss of earnings for one day per week. This loss in the case of a steady worker amounts to a reduction of one-seventh (14 per cent) of his income. To the blast-furnace workers this reduction of earnings was a peculiar cause of dissatisfaction. Many of the companies report that numbers of blast-furnace employees have quit rather than have their earnings reduced.

The second cause of dissatisfaction with the plans for eliminating 7-day work, as expressed by the workmen, is that except for the abolition of the long turn, the arrangement does not give them any particular advantages. In most of the plans adopted only a very few of the employees have Sunday as their rest day. Under some of the plans each man has the same week day off the year round, while under others he gets a different day each week. Neither of these arrangements is liked by the employees. On any day except Sunday, they say, there is nothing to do. Their friends are in the mills, their children are in school, and their wives are busy with regular household duties. There is nothing to interest them at home, they can not go to church, so that there is no alternative except to sleep all day or go to the saloons.

The plans introduced for the elimination of 7-day work have many objections from the standpoint of the steel manufacturers, the strongest opponents being the foremen and operating officials who are responsible for their enforcement. This opposition arises principally from the fact that the system of relieving men is so highly complex that the absence of a single man is sufficient to destroy the regularity of operations which is necessary for the successful production of steel. Furthermore, the majority of the operating officials object to the constant change of personnel in the makeup of the different crews which most of the plans necessitate. It will be seen that in the plan of the Iron and Steel Institute, page 167, the foreman would not have exactly the same crew on any two successive days, while frequently the "relief man" might be a workman entirely unknown to the foreman and unfamiliar with the work. On the other hand, many of the higher officials consider this constant shifting of personnel advantageous, since it accustoms each of the workmen to a number of positions and tends to prevent the growth of favoritism on the part of the foremen.

PLANS FOR THE ELIMINATION OF 12-HOUR WORK.

The partial introduction of the plans for the elimination of 7-day work, as described above, constitutes a great advance over the conditions which previously existed. The undesirability of the workman spending half his life in the mills, with no holidays except such irregular "days off" as he may choose to take, is definitely recognized. Most significantly, a definite and systematic attempt is being made to remove from the industry two of its worst features, namely, the working week of seven 12-hour days and the "long turn."

The plans can not, however, be said to have efficiently solved the problems which they attacked, since neither the workmen nor the manufacturers agree that their beneficial features have compensated for their many disadvantages. To the workmen the elimination of the long turn does not compensate for the loss of earnings, and most of the workmen state that the plans tested have not increased the amount of leisure which can be profitably used. For the manufacturers the plans have not produced either a more efficient or a more contented labor force. Instead, many of the manufacturers report that the workmen are dissatisfied and constantly leaving the plant, so that the labor force as a whole is less efficient than before the introduction of the plans.

It should be noted, moreover, that these plans have been tested under the most favorable conditions. The year 1911, in which steel production was far below normal, presented a very favorable opportunity for experiment. A large supply of efficient labor was available to act as "relief men." In fact, in many of the plants the mills and furnaces were so far below normal in their production that it was necessary to divide what work there was among the men ordinarily employed in the idle mills and furnaces so as to hold as many of the efficient workmen as possible. The existence of such generally depressed conditions in the industry disposed the workmen to accept their reduced earnings without active protest. One of the steel manufacturers stated that it would have been impossible to introduce the plans for eliminating 7-day work during an active and prosperous year, but that having succeeded in introducing them he hoped that it would be possible to maintain them during a period of activity. In a letter to the Bureau, one of the manufacturers whose blast furnaces are still on a 7-day basis stated that he was already getting some of the employees of a neighboring company who had left because of dissatisfaction with the plan for eliminating 7-day work, and that he expected to have a great many more applicants from this source as soon as business quickened and men were more ready to leave their jobs.

In view of the lack of success attending the introduction of the plans described, it seems desirable to consider other methods which have been proposed and tested for accomplishing the same purpose. The plans described above are based on the assumption that the chief evil of the schedule of working hours lies in the fact that it requires a man to work 7 days a week. Such an assumption arises chiefly from the large amount of public attention that the existence of 7-day work has attracted. This assumption does not represent the entire facts. All of the workmen interviewed stated that the hardship of the existing schedule did not consist in working every day in the week, but in being on duty for such a large part of their waking hours and in being called upon to work continuously through the 24 hours, both at the change of shift and when employees of the other shift who should relieve them were absent. So far as religious duties were concerned, they stated, a man would be in much better condition and much more apt to perform them either before or after a reasonably short day's work in the mills on Sunday than after a week's work from 6 in the morning until 6 in the evening or after a week of night work from 6 to 6 o'clock.[1] These statements of the workmen agree in their general aspect with the findings of the stockholders' committee of the Steel Corporation, which condemned the 12-hour day as strongly as the 7-day week on the ground that "it leaves [the workman] but scant time for self improvement, for companionship with his family, for recreation, and leisure."

The international commission on continuous industries which recently met in London (see p. 163) resolved at the conclusion of its sessions "that the 8-hour shift in continuous industries (industries working night and day) is the best shift system for such work, and should be strongly recommended both from the point of view of the physical and moral welfare of the workers and in the social and economic interests of society generally." In the majority of English blast furnaces this system of three 8-hour shifts to carry the work through the 24 hours of the day has been in operation for a number of years. Several blast-furnace owners appeared before the international commission and stated that they had found that the 8-hour shift system had contributed to the efficiency of the labor force of the blast furnaces and that they would not abandon it under any conditions. Representatives of the workmen also appeared before the commission and told of its many advantages to the workmen of the blast furnaces.

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[1] It should be borne in mind that the plans most commonly used do not give a man a Sunday off more than once in 7 weeks.

Furthermore, the 8-hour system has been introduced and is now being tested in the blast furnace of one of the large steel companies of the United States. The method of introducing this system and its results are described in the following quotation from the Iron Age of April 25, 1912:

> The announcement made by the Cambria Steel Co., of Johnstown, Pa., that beginning on May 1 it would gradually put its blast-furnace labor on an 8-hour basis is of great interest to the entire iron trades; but from the comments made in the daily press and elsewhere it is evident the matter is much misunderstood and needs explanation. For this reason C. S. Price, president of the company, has issued the following statement regarding the new arrangement:
>
> ### PRESIDENT PRICE'S STATEMENT.
>
> The trial of the 8-hour day at its blast-furnace department by the Cambria Steel Co. has gained such prominence in the papers as to require an explanation to correct some misunderstanding.
>
> The Cambria Steel Co. has been known for years as an 8-hour plant, owing to the fact that it has had a large percentage of its mill operations on an 8-hour basis—in fact, at every point at which that system could be economically and efficiently applied. For years the matter has been periodically taken up of applying it to the blast-furnace department, but conditions here, as elsewhere, were adverse, owing to the increased number of men and the expense involved unless there was a material reduction in wages.
>
> When the 6-day basis was introduced at a number of blast furnaces last year, by reducing the working hours from 84 to 72 hours per week, in compelling each man to "lay off" one day of 12 hours per week, the Cambria people saw an opportunity to try the 8-hour plan, so largely used in other departments of the works, and worked up a schedule on that basis. The men preferred seven 8-hour days with fewer men per turn, which would be a practical offset to the 72-hour basis. This was submitted on November last, and, after careful consideration during the winter, will be given a gradual tentative trial, both for conservative reasons and, of necessity, because additional men will be needed, which may require a long time to obtain. The choosing of this time to make a limited start was because of the approach of the summer or heated term.
>
> Nothing revolutionary will be undertaken. It has no connection whatever with any agitation that has been current for several years, but is simply a works detail of the management of the Cambria Steel Co. in further development along lines well established for many years.
>
> ### THE 6-DAY 72-HOUR WEEK NOT APPROVED.
>
> Supplementing the above, it may be said that the movement started last year by a number of the leading steel companies and pig-iron producers in changing the hours of labor at blast furnaces and steel works from 7 days per week of 12 hours per day to six 12-hour days per week, which meant an average reduction of wages of about 14 per cent to the men, did not appeal to the Cambria management; it did not believe this was the best solution of the problem and therefore did not adopt it. In fact, the Cambria Co. has always been a warm advocate of the 8-hour day for its men, and as far back as 1884 operated some of its finishing mills on an 8-hour turn and is doing so to-day. Last year during the slump the 12-hour turn was restored on one of its mills, and this

was done on the request of the men, who wanted larger earnings than they could get on the 8-hour turn, the mills not being operated to full capacity. Instead of adopting the 6-day 12-hour turn, the company set about to find out whether it would not be feasible to put its blast-furnace labor on an 8-hour basis of 7 days per week and at a reduction in wages that would be no greater to the men than would have been the case had it adopted the 6-day week with the 12-hour day. After months of careful study, frequent consultations with all classes of labor at its blast furnaces, and a practical test of the plan made recently, the management believes it has worked out this difficult problem and in a short time expects to have all its 8 blast furnaces on an 8-hour basis of 7 days per week. The new plan was worked out much in this way:

DETAILS OF THE NEW 8-HOUR PLAN.

Taking the case of a blast-furnace workman who at present is paid 20 cents per hour for his labor and who works 84 hours per week, his earnings are $16.80 per week. Had the company adopted the 6-day 12-hour schedule this man's pay would have been reduced from $16.80 to $14.40, or a little over 14 per cent. In making up its new plan the company figured entirely on the $16.80 basis per week, and after taking up individually the case of each man employed at its furnaces, no matter what the class of his labor was, it was found that by increasing its force of men by only one-seventh in number it could turn out as much pig iron and of as good quality as would have been the case had it adopted the 6-day 12-hour plan and at no greater cost. This additional number of men would have been required to establish the 6-day 12-hour arrangement now in vogue at other works. In other words, the men as a whole accept the reduction of $2.40 per week each under the new arrangement—this figure being used as a basis unit only—and at the same time each can earn just as much money as he would have earned under the 6-day 12-hour plan. This unit of $2.40 per week, it has been carefully figured out, will pay the wages of one-seventh more employees at the blast furnaces of the Cambria Steel Co. Thus the company has not increased its cost of making pig iron, the earnings of the men will be as large as they would have been had the company adopted last year the 6-day 12-hour plan, and the men are on the basis of an 8-hour day and a 7-day week.

Quite a number of the employees have already expressed personally to the management their gratification that the change is to be made to the 8-hour turn for 7 days rather than to the 12-hour turn for 6 days, and promise even greater efficiency in every way than they were able to give when working the long stretch of 12 hours per day 7 days a week. The company will require no more men when the 8-hour day is in effect at all of its eight furnaces, as stated above, than it would have required had it adopted the 72-hour week basis to displace the present scheme of 84 hours per week. It is planned to start the new arrangement at one or two furnaces first and increase the number as fast as the additional men can be obtained. Owing to the great scarcity of labor at all iron and steel plants at present, it may be some little time before the new schedule is effective at all the furnaces, but it is planned now to start the new working hours with the men employed in the engine rooms in the blast furnaces and gradually extend it to all other blast-furnace labor.

The principal advantages of the 8-hour shift system in the continuous processes of the industry are as follows:

1. It gives the workman time for complete physical recuperation, companionship with his family, self-improvement, and leisure even when employed 7 days a week.

2. From the experience of English blast-furnace owners who have adopted the 8-hour shift system, and from the experience in other industries, it will tend to produce a much more efficient force of workmen.

3. It affords a much more flexible working system than exists with the present schedule of working hours, particularly when the schedule of working time is affected by any of the highly complex systems of relief men for the elimination of 7-day work.

4. The 8-hour shift system can be introduced gradually and does not require a complete revolution of operation as did the plans for the elimination of 7-day work. In fact, in so far as the 8-hour shift system has as yet been introduced in the rolling mills it has come about by gradually placing the most strenuous occupations on an 8-hour shift system. In many mills at the present time men are working 12-hour and 8-hour turns side by side without any interference with the efficient operation of the mills.

5. It effectually prevents the existence of "long turns" of 24 or 18 hours, except under the unusual conditions in which long continued work by certain special men is necessary for the preservation of property or to permit interrupted operations to be resumed.

6. It gives a workman much more time for the performance of his religious duties than the majority of the plans for the elimination of 7-day work.

COST OF THE 8-HOUR DAY.

The preceding discussion has developed the fact that the most practicable remedy for the 12-hour day in continuous processes is the flat 8-hour day, three shifts of workers being employed instead of two.

The principal objection of the employers to such a change is that considerable increases in the hourly rates of wages would have to be made, resulting in a higher cost of production. Some increase in the rates of wages will undoubtedly be necessary. The workman will not, and in fact can not, accept an 8-hour day at the same hourly rate now paid for 12 hours, for this would mean a reduction of one-third in his daily earnings. The average earnings of the employees in the productive occupations of the iron and steel industry are 22.3 cents per hour, or $2.68 for 12 hours' work. For 8 hours' work per day at that rate only $1.78 would be received, or 12 cents per day less than the common laborers now average for a 12-hour day.

In the remaining pages of this chapter an attempt is made to estimate the cost of the increased wages incident to the introduction of an 8-hour day, and the influence of the additional labor cost on total cost and on selling prices.

It is possible, of course, that with the hours of labor reduced the workman's efficiency would increase sufficiently to compensate for a very considerable increase in his hourly rate. Such, indeed, was the result in the case of the company mentioned on page 187, and, as will be brought out more fully at the end of this chapter, some increase in efficiency is to be expected in all such cases, even although the increased efficiency may not compensate in full for the increased rates of wages. As, however, it is impossible to foretell with any accuracy the influence of shorter hours on efficiency, the following estimates as to the cost of introducing the 8-hour day are made on the assumption that efficiency would not be affected by the change.

Two sets of estimates are presented. They seek to determine, respectively:

(1) The maximum cost; arrived at on the assumption that hourly rates are so increased that the daily earnings of the workman would be the same as before.

(2) The probable cost; arrived at on the assumption that a compromise hourly rate is agreed on.

In each of these cases the cost of the change for the blast-furnace department is separately computed from that for the industry as a whole. This is done for the following reasons: In the first place, because of the necessity for continuous operation of the blast furnaces it is desirable that the benefits of the 8-hour system should first be extended to that department. Second, the labor cost in the blast furnaces forms a much smaller percentage of the total cost of production than in any of the other departments. The increase in the hourly rate of wages necessary to secure an adequate labor force on the three-shift system would therefore affect the cost of production in the blast furnaces much less than in the other departments, and consequently the system can be much more economically tested in the blast furnaces than elsewhere.

This study is primarily concerned with the cost incident to substituting three 8-hour shifts for two 12-hour shifts in continuous processes. If, however, such a change should be made in favor of the men employed in continuous processes, it seems only reasonable that some reduction should be made in the case of workmen in noncontinuous processes who work unduly long hours. Therefore the estimates here presented allow for the cost of reducing the hours of labor of all such workmen to not more than 60 a week (this being recognized in most industries as the normal maximum) with such increases in the tonnage rates and hourly rates that the weekly earnings would remain as before.[1]

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[1] The sheet and tin mills, in which the 8-hour system was introduced many years ago by the manufacturers, in order to secure increased efficiency and continuous operation of their mills, are omitted. Puddling mills are also omitted as they are largely operated on a system which gives a working week closely approximating that which would exist under an 8-hour system.

MAXIMUM COST OF CHANGE TO THE 8-HOUR DAY.

As explained above, this estimate of the maximum cost of introducing the 8-hour system is based on the assumption that in making the change wages are so readjusted that the workmen would receive the same amount for working 8 hours that they now receive for 12 hours. The estimate also provides for the cost of readjusting the working hours of all employees who now work more than 60 hours per week to a schedule of 60 hours or less without reducing their weekly earnings.

BLAST FURNACES.

If all the workmen employed in connection with blast furnaces worked 12 hours per day, it would be necessary to increase the average rate of wages per hour 50 per cent in order that the workmen should receive the same amount per day for 8 hours' work that they now receive for 12 hours' work. There are, however, a number of men in noncontinuous processes, particularly among the yard laborers, who work only 10 hours per day. In the estimate of maximum cost it is not proposed that the daily hours of men working 10 hours or less for 7 days a week should be shortened to 8 hours, but only that they should be put on a 6-day schedule. The proportion of these 10-hour workmen varies in different blast-furnace plants, therefore, in order to estimate with some degree of accuracy the per cent of increase that would follow the changes in hours proposed, a careful calculation was made of the necessary increase in 6 large blast-furnace plants employing 3,062 men, or about one-eleventh of the entire number normally employed in the blast furnaces. These plants all pay very much better wages than the average and are efficiently operated. The results of the calculations are given in the following table:

ESTIMATED INCREASE OF LABOR COST NECESSARY IN CHANGING FROM A 12-HOUR DAY TO AN 8-HOUR DAY, WITHOUT REDUCING WEEKLY EARNINGS, IN BLAST FURNACES OF 6 LARGE PLANTS.

Plants.	Number of employees.	Average hourly earnings on present basis.	Average hourly earnings on 8-hour basis.	cent of increase in average earnings per hour.
Plant A	1,005	$0.210	$0.283	34.8
Plant B	392	.201	.292	45.2
Plant C	437	.188	.279	48.5
Plant D	400	.198	.261	32.2
Plant E	350	.202	.282	39.1
Plant F	478	.210	.315	50.0
Total	3,062	.203	.286	40.6

For the 6 blast-furnace plants the average increase in earnings per hour necessary to give every man the same pay for 8 hours' work that he now receives for 12 hours and to make the other readjustments in hours specified above is found to be 40.6 per cent. The average hourly earnings of all employees in American blast furnaces in 1910 were 17.2 cents. Applying the increase of 40.6 per cent to this figure, it is found that if the assumed changes in working hours were made the average hourly earnings of blast-furnace employees would be 24.2 cents.

Since no increase in productive efficiency is here assumed to follow the change to the 8-hour system the total labor cost per ton of product would be increased in the same proportion. The average labor cost of producing Bessemer pig iron from 1902 to 1906 in the blast furnaces of the United States is shown by the recent report[1] of the Commissioner of Corporations to have been 77 cents per ton,[2] or 6.4 per cent of the total cost of production ($12.10) during the same period. An increase of 40.6 per cent would make the labor cost $1.08, but since labor cost is so small a part of the total cost of production it would increase the total cost only 31 cents per ton or 2.6 per cent.

The average selling price of pig iron during the same period (1902 to 1906) was $18 or 48.8 per cent above the cost of production. If the same differential were maintained after introduction of the 8-hour day on the basis assumed the selling price would be increased 47 cents (2.6 per cent).

For convenience of reference these effects of the introduction of the 8-hour day in blast furnaces are summarized in the following tabular statement:

INCREASES IN RATES OF WAGES PER HOUR, COST OF PRODUCTION, AND SELLING PRICE WHICH WOULD BE REQUIRED TO INTRODUCE THE 8-HOUR SYSTEM IN THE BLAST FURNACES, ON THE BASIS THAT EACH WORKMAN IN CONTINUOUS PROCESSES EARNED THE SAME AMOUNT FOR 8 HOURS' WORK THAT HE NOW RECEIVES FOR 12 HOURS AND THAT PRODUCTIVE EFFICIENCY WAS UNCHANGED.

	Amount under 12-hour system.	Amount under 8-hour system.	Required increase.	
			Amount.	Per cent.
Average hourly earnings	$0.172	$0.242	$0.07	40.6
Labor cost of production per ton [3]	.770	1.080	.31	40.6
Total cost of production per ton [3]	12.100	12.410	.31	2.6
Average selling price per ton [4]	18.000	18.470	.47	2.6

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[1] Report of the Commissioner of Corporations on the Steel Industry: Part II, Cost of Production (Preliminary Report, January 22, 1912), p. 21. The data for 1902–1906 are the only complete and accurate data available. The report of the Commissioner of Corporations indicates that in 1910 labor cost was less than in 1902–1906 in spite of an increase in wages.

[2] See p. 281.

[3] Based on preliminary report of Commissioner of Corporations mentioned in note (1). Figures shown are for 1902–1906. See this volume, Chapter XI, for methods of calculation.

[4] Weighted average from quotations 1902–1906 of American Iron and Steel Association.

BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS.

The basis of the estimates of the cost of introducing the 8-hour system, it will be remembered, is that the 8-hour day will apply only to positions requiring continuous operation throughout the 24 hours. In the case of the men working only during the daytime provision is made for reducing their working hours to a schedule of not more than 60 hours per week at the same weekly earnings that they now receive. Considering the industry as a whole, these "day men" constitute a large part of the working force. Of the entire labor force of the industry 37 per cent customarily work 60 hours or less per week. In making the estimates it is assumed that the working hours of this 37 per cent will remain as they are at present and that there will consequently be no change in their hourly rates of wages. Furthermore, 20 per cent of the employees customarily work more than 60 and less than 72 hours per week. In order to shorten their weekly schedule to 60 hours or less per week, only a slight change in the hourly rates of wages would be necessary to maintain their weekly earnings at the amount which they now receive. The total number of employees in whose case an increase of 50 per cent in the hourly rate of wages would be necessary to maintain their weekly earnings at the present level form somewhat less than 42 per cent of the total labor force of the industry.

In order to discover just what percentage of increase in the hourly rates of wages would be required to introduce the 8-hour day into a typical steel plant, on the basis assumed, a careful calculation of the average cost was made for six large plants employing in all 28,452 workmen, or about one-ninth of those employed in the blast furnaces, steel works, and rolling mills of the United States.[1] The results of these calculations are shown briefly in the following table:

ESTIMATED INCREASE OF LABOR COST NECESSARY IN CHANGING FROM A 12-HOUR DAY TO AN 8-HOUR DAY, WITHOUT REDUCING WEEKLY EARNINGS, IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS OF 6 LARGE PLANTS.

Plants.	Number of employees.	Average hourly earnings on present basis.	Average hourly earnings on 8-hour basis.	Per cent of increase in average earnings per hour.
Plant A	7,818	$0.239	$0.329	37.6
Plant B	4,092	.232	.321	38.7
Plant C	3,049	.219	.297	35.6
Plant D	3,892	.233	.302	29.7
Plant E	4,150	.253	.333	31.8
Plant F	5,451	.218	.289	32.6
Total	28,452	.233	.314	34.7

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[1] Each of these plants included blast furnaces, steel works (Bessemer or open-hearth), and rolling mills. In no department of any of the six plants was the 8-hour day in effect, except for a very few employees in unusually hard positions, e. g., pit cranemen.

In these six plants an average increase of 34.7 per cent in the hourly rate of wages would be necessary to maintain the existing level of weekly earnings after the introduction of the 8-hour day in all continuous operations and the reduction of the weekly schedule of all workmen in noncontinuous processes to 60 hours per week or less. The average hourly earnings of all employees in the industry is approximately 22 cents under the existing schedule of working hours. Applying the average percentage increase determined above to the industry as a whole, if the assumed changes in working hours were made and the existing level of weekly earnings maintained, the average hourly earnings of all employees would be approximately 30 cents per hour.

The cost of all labor performed in producing the principal finished products, from the smelting of the ores to the completion of the finishing processes, and the proportion of this labor cost to the total cost of production are shown in the following table:

PRODUCTION, TOTAL WORKS LABOR COST, AND TOTAL COST OF PRODUCTION OF THE PRINCIPAL FINISHED PRODUCTS.

Kinds of product.	Production in 1910 (gross tons).	Total works labor cost per ton, average 1902-1906.[1]	Total cost of production per ton, average 1902-1906.	Per cent which labor cost is of total cost of production.
Merchant bars	3,785,731	$5.44	$26.69	20.5
Wire rods	2,241,830	3.86	25.25	15.3
Structural shapes	2,266,890	3.83	24.83	15.4
Bessemer rails	3,636,031	2.84	18.80	15.1
Sheared plates	2,807,728	4.88	26.99	18.1
Average weighted by production		4.22	24.79	17.1

[1] For the method of computing total labor costs so as to include the labor expended in smelting, steel making, and all preliminary rolling, as well as in finishing processes, see Chapter XI, p. 281.

The tonnage of the five products shown above constitutes more than two-thirds of the entire output of finished products of the industry. For these five products the per cent which the labor cost is of the total cost of production ranged from 15 to 21 per cent. The average labor cost of these five principal products (weighted according to the tonnage produced) was $4.22 per ton, or 17.1 per cent of the total cost of production.

It has been shown above that the average increase in the labor cost per hour required to make the assumed changes on the maximum basis would be 34.7 per cent. Assuming for the present that no increase in productive efficiency followed the introduction of the 8-hour day, the labor cost per ton after making the assumed changes would be increased 34.7 per cent, or $1.46 per ton. This would increase the total cost of production per ton to $26.25, or 6 per cent above the average cost of production ($24.79) on the existing schedule of working hours.

The selling price of wire rods is not available for the period 1902 to 1906. The average selling price of the other four products (bars, rails, structural shapes, and plates), weighted according to tonnage produced, was $34.24 during the period 1902 to 1906. The average cost of production of these four products during the same period was $24.63. Assuming that the differential of 39 per cent between the cost of production and selling price was maintained after the changes, the selling price would be increased $2.05 per ton (6 per cent).

It may be noticed, however, that each of these products except steel rails varies in price during each year through a range of 10 per cent or more, so that the increase arising from a complete change of working hours would actually be much less than the fluctuations that take place each year under existing conditions. Furthermore, there was no increase in prices following the general increase of wages in 1910.

In the following tabular statement are summarized the estimates presented in the foregoing pages as to the effects which could be assumed to follow the proposed changes in hours:

INCREASES IN RATES OF WAGES PER HOUR, COST OF PRODUCTION, AND SELLING PRICE NECESSARY TO INTRODUCE THE 8-HOUR SYSTEM WITH CERTAIN OTHER CHANGES IN HOURS IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS, ON THE BASIS THAT EACH WORKMAN IN CONTINUOUS PROCESSES EARNED THE SAME AMOUNT FOR 8 HOURS' WORK THAT HE NOW RECEIVES FOR 12 HOURS AND THAT PRODUCTIVE EFFICIENCY WAS UNCHANGED.

	Amount under 12-hour system.	Amount under 8-hour system.	Required increase.	
			Amount.	Per cent.
Average hourly earnings	$0.22	$0.30	$0.08	34.7
Labor cost of production per ton [1]	4.22	5.68	1.46	34.7
Total cost of production per ton [1]	24.79	26.25	1.46	6.0
Average selling price per ton [2]	34.24	36.29	2.05	6.0

[1] Average of 5 principal products (1902–1906) aggregating two-thirds of all finished tonnage.
[2] Average of 4 principal products (1902–1906) aggregating three-fifths of all finished tonnage.

PROBABLE COST OF CHANGE TO THE 8-HOUR DAY.

In the preceding statements have been presented the maximum increases which could be reasonably supposed to follow the introduction of the 8-hour system in the industry. It seems certain, however, that the steel manufacturers would not offer nor would the employees demand the same earnings for an 8-hour day that they now receive for working 12 hours. This statement is based on interviews with a large number of workmen who said that they would be satisfied to receive somewhat less for 8 hours than they now are paid for 12 hours if that would secure the change, and also upon the fact that in the cases where men have actually been changed from a 12-hour day to an 8-hour day, either to secure larger output or at their own request, their hourly or tonnage rates have not been increased 50 per cent, but a much smaller percentage. Most of the workmen interviewed said that while they would not be able to accept 8 hours' work at their present hourly rates, they would gladly secure an 8-hour day if they were given the equivalent of 10 hours' pay at the prevailing rates per hour. This would mean that the hourly rates must be increased 25 per cent. To illustrate by a specific example, a man who now receives 20 cents per hour for 12 hours' work, or $2.40 per day, would receive for 8 hours' work $2, or 25 cents per hour. In the case of the common laborers it would mean that the laborer working 8 hours a day in the mills would receive the same amount per day as the laborer working 10 hours per day in the yards.

A few of the interviewed workmen objected to any change in the hours of labor unless they were paid just as much per day or per week as they now receive. These were all immigrant workmen who were anxious to earn the largest possible amount in the shortest time without regard to the hardships that might be suffered in earning it. Two of these workmen who objected to any change in the conditions that would at all reduce their weekly earnings were working at the time constantly on the night shift, 13 hours per night for 7 nights a week, making a total of 91 hours per week. The American workmen interviewed, without exception, stated that they would welcome an 8-hour day if their hourly or tonnage rates were 25 per cent higher than at present, thus giving them the same daily earnings that they would receive for 10 hours' work at the present rates.

This accords very closely with the experience of manufacturers who have actually changed the hours of labor from 12 to 8 per day, except that tonnage rates are frequently not changed, the increased efficiency of the workmen on 8 hours being supposed to compensate. The steel company mentioned above (p. 173) which changed its blast furnaces from the 12-hour to the 8-hour system gave its men the same pay for 56 hours' work that they would have received for 72 hours at the prevailing rates, or an increase of 28.6 per cent in the hourly rates. The workmen are reported as being well pleased with the change. The same company in changing several of its small rolling mills from 12 to 8 hours at the request of the workmen, made no change whatever in the tonnage rates. Another large steel company in 1909 changed its Bessemer converters, its blooming mills, and billet mills from 12 to 8 hours. The hourly rates were increased on an average about 22 per cent, the greatest increase being 25 per cent. Numerous other instances might be cited, but in general it may be said that in the cases of changes from 12 to 8 hours which came to light in the present investigation the hourly rates were usually increased between 20 and 30 per cent, only a very few exceptional cases being discovered where the increase was more than 30 per cent. The average of these actual changes is about 25 per cent and agrees very closely with the employees' statements of what they regard as a fair compromise.

It may be noted also that in hiring its employees the steel industry is largely in competition with other industries in which the hours of labor are 10 or less per day. If the steel industry should not be able to secure an adequate force by paying daily wages equivalent to the amount earned in 10 hours at the prevailing hourly rates it would seem to indicate either that its general scale of wages is lower than in other industries or that the work in the steel industry is decidedly harder than in other industries and should be compensated accordingly.

It seems fair, therefore, to accept as a basis of estimate for determining the probable cost of introducing the 8-hour day into the industry generally that the hourly rates of men now working 12 hours per day would have to be increased approximately 25 per cent and that the rates of other workmen whose hours would be changed would be increased proportionately.

The method of making the estimates has been shown in such detail in the discussion of the maximum increases that would follow the change to the 8-hour system that it seems necessary in the following pages to present only the results of the estimates of the probable cost.

BLAST FURNACES.

On the basis above outlined the probable cost may be easily computed by taking in each case half of the maximum increase shown above. The results are shown in summary form in the following tabular statement:

INCREASES IN RATES OF WAGES PER HOUR, COST OF PRODUCTION, AND SELLING PRICE NECESSARY TO INTRODUCE THE 8-HOUR SYSTEM IN THE BLAST FURNACES, ON THE BASIS THAT EACH WORKMAN IN CONTINUOUS PROCESSES EARNED THE SAME AMOUNT FOR 8 HOURS' WORK THAT HE NOW RECEIVES FOR 10 HOURS AND THAT PRODUCTIVE EFFICIENCY WAS UNCHANGED.

	Amount under 12-hour system.	Amount under 8-hour system.	Required increase.	
			Amount.	Per cent.
Average hourly earnings	$0.172	$0.207	$0.035	20.3
Labor cost of production per ton[1]	.770	.935	.165	20.3
Total cost of production per ton[1]	12.100	12.265	.165	1.3
Average selling price per ton[2]	18.000	18.235	.235	1.3

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[1] Based on preliminary report of Commissioner of Corporations on Steel Industry, Part II. Figures shown are for 1902–1906. See this volume, Chapter XI, for methods of calculation.

[2] Weighted average from quotations 1902–1906 of American Iron and Steel Association.

The results of these calculations show that a complete readjustment of the hours of labor of the blast furnaces to the 8-hour system could be made with an increase of only 1.3 per cent in the cost of production and in the selling price of pig iron, even if no increase in efficiency is assumed to follow the change. Such a change in prices would hardly be noticeable in the wide fluctuations of pig-iron prices which occur during every year. The extent of these fluctuations in the price of Bessemer pig iron during the past 10 years is shown in the following table:

FLUCTUATIONS IN THE AVERAGE MONTHLY PRICE OF BESSEMER PIG IRON AT PITTSBURGH, 1902 TO 1911.

[Quotations of the Iron Age, vol. 89, No. 1, p. 50.]

Years.	Lowest average monthly price per ton.	Highest average monthly price per ton.	Amount of fluctuation per ton during year.	Per cent fluctuation is of lowest average price.
1902	$16.70	$21.75	$5.05	30
1903	14.40	22.15	8.25	57
1904	12.40	16.65	2.25	18
1905	15.20	18.35	3.15	21
1906	18.10	23.75	5.65	31
1907	19.34	24.27	4.93	25
1908	15.71	19.00	3.29	21
1909	15.78	19.90	4.12	26
1910	15.82	19.90	4.08	26
1911	15.00	15.90	.90	6

In each of the past 10 years the fluctuation in prices of pig iron has been greater than 5 per cent, and in all except 2 of the years the fluctuation has been greater than 20 per cent. The average annual fluctuation in the price of pig iron for the past 10 years has been 26 per cent of the average of the lowest quoted prices. With such extreme fluctuations in prices as these, the increase of 1.3 per cent in selling price estimated as the probable cost of introducing the 8-hour system would scarcely be noticeable.

BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS.

The results of a calculation of the probable cost of introducing the 8-hour system generally throughout the industry, on the same basis shown above for blast furnaces, are given in the following tabular statement.

It should be noted that the sheet and tin mills which are already operating on the 8-hour system are not included. The estimates are limited entirely to those departments in which the 12-hour system is almost universally in vogue, and are designed to show the probable results of the 8-hour system on cost of production and selling price of the products of those departments. In making these estimates it is assumed that no increase of efficiency would be secured by the introduction of the 8-hour system. This assumption is made only because it is impossible to estimate what such increase would be.

INCREASES IN RATES OF WAGES PER HOUR, COST OF PRODUCTION, AND SELLING PRICE NECESSARY TO INTRODUCE THE 8-HOUR SYSTEM IN THE BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS, ON THE BASIS THAT EACH WORKMAN IN CONTINUOUS PROCESSES EARNED THE SAME AMOUNT FOR 8 HOURS' WORK THAT HE NOW RECEIVES FOR 10 HOURS AND THAT PRODUCTIVE EFFICIENCY WAS UNCHANGED.

	Amount under 12-hour system.	Amount under 8-hour system.	Required increase.	
			Amount.	Per cent.
Average hourly earnings	$0.22	$0.26	$0.04	17.4
Labor cost of production per ton [1]	4.22	4.95	.73	17.4
Total cost of production per ton [1]	24.79	25.52	.73	3.0
Average selling price per ton [2]	34.24	35.27	1.03	3.0

[1] Average of 5 principal products (1902–1906) aggregating two-thirds of all finished tonnage.

[2] Average of 4 principal products (1902–1906) aggregating three-fifths of all finished tonnage.

As has been pointed out in detail on pages 179 and 180, these estimates include the effects of the assumed increases in rates for all the labor that is expended within the works on the production of the finished products, including smelting of the ore, making of the steel, and every step in the working and finishing of the salable product. Taking all these cumulative processes into consideration the estimates given above show that the complete introduction of the 8-hour system would probably increase the cost of production and the selling price of the most highly finished products of the industry that are now made under the 12-hour system only 3 per cent.

In making the above estimates it has been assumed that no increases in productive efficiency would be secured by the 8-hour system. This assumption has been made only because it is impossible to estimate with any degree of accuracy what the increase would be, and not because it is believed by those who have given the matter consideration that no increase would take place. On the contrary, past experience indicates that considerable increases in efficiency may be expected as a result of the 8-hour system. It is impossible to demonstrate this statistically from the records of mills that have changed their hours, for in every case for which accurate records were obtainable some change either in equipment or in method of operation was made at the same time the mills went on the 8-hour system. It may be noted, however, that the steel company quoted above (p. 173) in changing its blast furnaces to the 8-hour system found it possible to reduce the number of men on each shift sufficiently to counterbalance the increase of 28.6 per cent in their hourly wages. Several British blast-furnace operators stated before the recent international conference on continuous industries[1] that the increase in output per employee had compensated for the increased hourly rates paid their employees on the introduction of the 8-hour system and that they would not willingly return to the 12-hour system. As the rate of production of a blast furnace is influenced in a less degree by the exertions of its labor force than other departments of the industry, it would seem theoretically to be the least likely to give improved results under the 8-hour system. The Bessemer converters and the rolling mills on the other hand respond readily to increased exertions on the part of a crew of workmen, and it is principally in these departments that the 8-hour day has been introduced hitherto. Furthermore, in these departments the workmen who work 12 hours in the most exhausting positions are usually relieved after 30 minutes' work and rest for 30 minutes (i. e., two men are provided for each job). Experience has shown that with an 8-hour day 15 minutes' rest is sufficient to allow full recuperation in such cases. In a great many cases arrangements can be made to allow three men for every two of such exhausting positions so as to provide this rest of 15 minutes out of every 45 minutes. In all such cases the change would more than compensate for an increase of 25 per cent in the hourly rate of wages.

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[1] See Report of the Special Commission on Hours of Labor in Continuous Industries, London, July, 1912, p. 14.

Numerous illustrations of increases in productive efficiency following the substitution of the 8-hour system for the 12-hour system might be cited from other industries. It seems sufficient, however, to call attention to the fact that the sheet and tin mills, in which most of the material is handled by hand, were many years ago changed to the 8-hour system by the voluntary action of the manufacturers in order to secure increased efficiency and continuous operation of their mills. It is true that in this case the change was not from a 12-hour system, but from an irregular system based on the number of "pairs" rolled, which daily caused interruptions of production for several hours. The significant fact is that practically every mill of this kind in the United States is operated with three shifts of 8 hours each, and there is no desire on the part of either the manufacturers or the workmen for the substitution of the 12-hour system.

In a very large number of positions in the steel industry, however, it seems impossible that any increase in productive efficiency would follow a change to an 8-hour day. It should be noted, however, that the increase in productive efficiency of the employees need not be relatively as great as the increase in hourly rates of wages in order to secure increased profits for the manufacturer. This is due to the fact that so large a proportion of the costs of production are fixed and overhead costs that any increase in the output of each producing unit greatly reduces the cost of production. For example, let it be assumed that a manufacturer is operating on the 12-hour system a mill producing 10 tons per hour at a total cost of $100 per hour, or $10 per ton. Of this cost let it be assumed that $30 is for labor and $70 for other costs. A change is made to the 8-hour system with an increase of 33⅓ per cent in the cost of labor per hour. This would make the labor cost $40 per hour and the total cost $110 per hour. If as a result of the shorter hours the workmen increased in efficiency only 10 per cent the manufacturer would lose nothing, for he would now obtain 11 tons per hour at a cost of $10 per ton.

ACTUAL RESULTS OF THE 8-HOUR SYSTEM IN A STEEL FOUNDRY.

Since the above discussion of the probable results and cost of the 8-hour system in steel mills was written, the results of a test of the 8-hour system in the open-hearth department of one of the large steel foundries have been made public in an address delivered before the American Foundrymen's Association. As this is the first occasion, so far as is known, in which a set of open-hearth furnaces have been operated permanently on the 8-hour system in the United States, the results are of peculiar interest.

A brief résumé of the principal facts with regard to this trial of the 8-hour system is given in order that the detailed account of the results may be more easily understood.

1. The steel foundry in which the 8-hour system was tried was that of the Commonwealth Steel Co., Granite City, Ill. The open-hearth department consists of four 25-ton basic open-hearth furnaces,[1] which directly require for their operation 22 men for two 12-hour shifts or 33 men for three 8-hour shifts. The plant as a whole, which produces open-hearth steel castings exclusively, employs about 2,300 workmen.

2. The workmen in the open-hearth department and the boiler room of this plant prior to February 5, 1912, worked on two shifts of 12 hours each for 6 days a week. On that date the system was changed and three shifts of 8 hours each were substituted.

3. The number of men on each shift (11 men) was unchanged in the open-hearth department, but in the boiler room it was found that only 10 men were required for the three 8-hour shifts in place of 8 men on the two 12-hour shifts.[2]

4. An increase in the hourly rates of wages was made for all men when changed to the 8-hour shift system, ranging from 14 to 22 per cent and averaging about 20 per cent.

5. Exactly the same products were made under the two systems of working hours, but in spite of the increase in the hourly rates of wages and the employment of a larger number of men there was a slight decrease in the cost of production, owing to the higher efficiency secured under the eight-hour system.

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[1] Only three of these furnaces are operated at any one time, the other being held in reserve.

[2] See detailed statement on p. 192.

6. Very considerable reductions in the amount of extra pig iron charged and in the amount of fuel oil consumed were obtained under the 8-hour system. These reductions alone were almost great enough to pay for the additional labor employed.

7. In addition much more accurate results were obtained in the quality of the castings, as is shown in detail on page 191. Not only were the physical and chemical specifications more accurate under the 8-hour system, but the percentage of cracked castings was decidedly decreased.

8. The workmen not only were satisfied but were very much in favor of the 8-hour system, in spite of the fact that their wages for the 8-hour day were about 20 per cent less than they had been for the 12-hour day.

The results are described in detail in the address of the general superintendent of the Commonwealth Steel Co. before the American Foundrymen's Association. The address was reprinted in full in several of the trade journals, and, therefore, only such parts of it are given here as are pertinent to the question of the 8-hour system in the steel industry as a whole.[1]

> The question of the long shift, so far as the American Foundrymen's Association is concerned, crystallizes into a consideration of the melter and his furnace helpers, and has to do with the steel foundry. I assume it to be unnecessary to set forth in any sort of detail the nature of the steel-maker's occupation to those members of this association who are engaged in the manufacture of steel castings. Briefly, however, for the benefit of all others who may be interested in the subject, the work is distinctly arduous, physically and mentally, carries a responsibility which puts a man's nervous system in frequent high tension, and is especially trying on the physical system during the summer months. It can, however, be truthfully stated that the difficulties of the work are not constant but periodic, also that the Sunday shift in the steel foundry (not necessarily in the steel mill) is a very easy one. A furnace man may have a considerable interval of comparative relaxation when his furnace and heat respond nicely to his manipulation and weather conditions prevail which do not make the working temperature a hardship. And again he may, in spite of all the experience and skill at his command, have about as trying and exhaustive a day's work, without intermission and for several days in succession, as one can readily imagine. * * *
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> The company with which I am associated some time ago inaugurated three eight-hour shifts as applying to the furnace and boiler crews, both of which had previously worked twelve-hour turns. It had been my opinion, and that of my immediate superior, that such a revision of our working schedules in these departments would be accompanied with so much more efficient handling of the furnaces that if the rates per hour were reasonably increased to remove the

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[1] R. A. Bull, "Economic side of the 12-hour shift in the steel foundry"; Transactions of the American Foundrymen's Association, 1912, p. 131.

natural disinclination of the men to receiving only two-thirds of their former monthly income, the final result would show economy. This was the purely business side of the question, whose humanitarian aspects received our first consideration. A careful adjustment of wages was planned which yielded an increase per hour of 22 per cent to the first helpers, 18 per cent to the second helpers, and 16 per cent to the third helpers. Even the door boy was included in the scheme, and was to receive an advance of 19 per cent per hour. The boiler firemen were to be increased 19 per cent per hour, and the coal passers 14 per cent. It should be borne in mind that none of the men affected had asked for a change in the shift hours, or an increase of wages, nor had any plant in our vicinity any such change in contemplation.

Permission of our principal executive officers was obtained to inaugurate the new plan, and when it was put into effect it came as a glad surprise to the various crews. No inducements were offered them to render more efficient service, nor was any suggestion made that we proposed to keep comparative data. But it was an easy matter to make comparisons, because we had a meter registering within one-half of 1 per cent of accuracy by careful test on each open-hearth furnace line to record the fuel-oil consumption, a magnetic recorder to indicate the frequency with which the furnace burners were reversed, a system by means of which all extra pig iron used in each heat was weighed and recorded, a recording pressure gauge to show the steam pressure maintained in the boiler room, and finally the chemical analyses and physical tests customarily made for every heat to determine the relative qualities of the product.

Before studying the comparative record, permit me to state for your more intelligent consideration of the various showings a few important facts. The first four weeks prior to the change, and the first four weeks following, were taken as those best for comparison, because working conditions for these two periods were as nearly identical as could readily be found in our plant. The melting stock, the fuel oil, and the boiler coal were of uniform quality throughout, so far as the same grades or brands of these materials may possibly be. The demand made upon each 250-horsepower boiler under fire was practically the same in each case, the air load being steady, but the electrical load extremely intermittent for the entire eight weeks, a chronic condition which in our case militates greatly against a desired uniformity of 125 pounds of steam pressure. The practice on the open-hearth platform had obtained for years of reversing the burners every 20 minutes when a furnace was charged, and every 30 minutes when empty. It was of course the object to make the least possible additions to the percentage of pig iron charged, and the furnace men were required to exercise such judgment in this respect as would keep the amount of extra pig within reasonable bounds, and as low as possible. Naturally they were also expected to keep the burners nicely adjusted and to maintain the proper temperature of the bath at the lowest possible oil consumption. The furnaces were basic, and 47,000 pounds of metal was charged per heat. The shift hours under the old plan had been from 6 to 6; under the new arrangement they are from 7 a. m. to 3 p. m., 3 p. m. to 11 p. m., and 11 p. m. to 7 a. m., these being the most convenient, because of local conditions. The crews change their shifts the first day of each week, thus giving every three weeks the full daylight turn to each crew. Having made the above points clear, I refer you to the comparative record, on which you will find certain results not shown as actually found, but indicated in a fashion sufficient for ready comprehension.

It will be readily understood that we were greatly gratified at the comparison, which indicates fully a more economical and efficient manipulation of both open-hearth and boiler furnaces. It will be observed that the differences in most cases are slight, but the pleasing and important feature is that the essential ones are in favor of the short shift. If we had had suitable means of weighing our coal as it was stoked, we could have elaborated our boiler-room records, for we had on our boiler line a water meter, and on our feed-water heater a thermometer, to indicate the evaporation. But we did not have at hand convenient facilities for exactly determining our coal consumption.

It was not to be expected that the greatest improvement would take place immediately after the change, and had all working conditions been some months afterwards practically the same as they were previous to the adoption of the 8-hour shift there could have been made a fairer comparison. Certain important working conditions having changed, it was advisable to compare periods as indicated. But it is interesting to know that in those instances where conditions remained constant there was a noticeable improvement the second month as compared with the first month after the new schedule was in force, as, for example, the reduction in the average amount of extra pig iron charged per heat, from 424 pounds to 137 pounds.

I do not know if any such comparisons as those made the basis of this paper have heretofore been made in a similar fashion. It is quite possible that the idea has some degree of novelty in certain of its details, for, notwithstanding the criticisms recently directed against the 12-hour shift, its prevalence is still almost universal in furnace operation in this country. And I feel satisfied that any careful comparison along the lines indicated by the record herein shown would convince any steel manufacturer of the wisdom of operating with three 8-hour shifts purely from an economic standpoint. Speaking for the people with whom I am associated, we are greatly pleased over the change. And I can speak for the men in the same terms, for our furnace men are enthusiastic in their praise concerning the new plan. And there is no small amount of inward satisfaction in the knowledge that we have done a humane thing. I have felt that you ought to know about it, and I have believed that once having the knowledge in your possession at least some of you would fall in line of your own free will, and with better grace than will be possible when in the future you may find yourselves required by statute to discontinue your present schedules of working hours. It may be argued that, while the demands of humanity and economy are admittedly strong on the furnace platform in favor of the 8-hour shift, its adoption is unwise there because of the effect it might have upon workmen in other departments, where the 9 or 10 hour day is at present prevailing, and where conditions would not commercially permit the universal 8-hour day. But conditions in a steel foundry can not be found in any other department that are at all similar to those found around the furnaces, and that fact is apparent to molder, pattern maker, core maker, machinist, electrician, or any other mechanic. Any argument which can be so readily met must fall, and its best answer is found in the fact that its adoption in the plant whose experiences have in a way been here described has resulted in no tendency toward the demand for an 8-hour day among any of the skilled trades represented in our organization, after the lapse of sufficient time to make such a movement at all probable as a result of the precedent.

Therefore, viewed from any conceivable angle, I claim the change is justifiable, and you will do well to make it, so far as your open-hearth furnaces are concerned. As to your boiler firemen, each operating head must decide for himself. In our particular case it appeared to be, and finally proved to be, advisable from every standpoint. Conditions in certain other boiler rooms are very different from ours, practically the entire evaporation taking place during the daylight hours in many of them. Since the results are of some interest, however, I have included the comparisons made in our power plant. Reverting finally to consideration of the steel maker, whose performance under both schedules is made the burden of this argument, the basic principle is absolutely sound, and rests on the incontrovertible fact that you can not expect any man to give you the best that is in him when you keep him employed without intermission for 12 hours per day, 7 days per week, at work making a heavy demand upon his mental and physical powers, under conditions of high temperature such as obtain on a furnace floor. To expect the best results under such circumstances is folly, and to continue operating under them spells, not the title of this paper, but the costly side of the 12-hour shift.

OPEN-HEARTH FURNACES.

	Twelve-hour shift.	Eight-hour shift.
Average amount of extra pig iron charged per heat	556 pounds	424 pounds.
Average amount of fuel oil consumed per heat	1,275 gallons	1,138 gallons.
Average amount of fuel oil consumed per ton of metal charged	55 gallons	49 gallons.
Average number of cracked castings per heat	0.49	0.37.
Average of longest intervals between reversals of burners during 12-hour periods.	28 minutes	26.7 minutes.
Average of chemical analyses of all heats:		
Carbon	Correct percentage	Correct percentage.
Phosphorus	0.011 per cent	0.011 per cent.
Sulphur	0.022 per cent	0.022 per cent.
Manganese	2 points under	Correct percentage.
Silicon	1 point over	Do.
Maximum phosphorus in any heat	0.022 per cent	0.018 per cent.
Maximum sulphur in any heat	0.025 per cent	0.025 per cent.
Average physical tests of all heats:		
Yield point per square inch	13 per cent over	15.5 per cent over.
Tensile strength per square inch	5.9 per cent over	5.8 per cent over.
Elongation in 2 inches	4.6 points over	4.1 points over.
Reduction of area	7.9 points over	7.2 points over.
Minimum physical tests of any heat (not combined results of one bar, but individual minimums of results covering all bars):		
Yield point per square inch	2.5 per cent under.	7.7 per cent over.
Tensile strength per square inch	4.7 per cent under.	1.4 per cent under.
Elongation in 2 inches	5 points under	3 points under.
Reduction of area	8.3 points under	7.6 points under.

The term "point" means a hundredth of 1 per cent where analyses are referred to, and elsewhere 1 per cent, but in all cases it refers to differences from works standard, being found by simple subtraction. In no case does it indicate relative or proportionate results. Where such are shown they are indicated by "per cent" followed by "over" or "under." "Over" and "under" mean, respectively, results more or less than those desired by plant requirements, and we have no reference to A S T M standard specifications, the requirements of which are fully met in all the minimum results obtained under the 8-hour shift. "Correct percentage" means exactly the composition desired. Lowest possible content of phosphorus and sulphur demanded by plant requirements.

BOILER ROOM.

	Twelve-hour shift.	Eight-hour shift.
Number of times when steam pressure fell below 110 pounds.....	77	42
Number of times when steam pressure fell below 105 pounds....	9	3
Number of times when steam pressure fell below 100 pounds.....	1	0

Operating expense for boiler room labor: On 12-hour shifts, from 6 a. m. to 6 p. m., one head fireman, two second firemen, and two coal passers were employed; and from 6 p. m. to 6 a. m., one head fireman, one second fireman, and one coal passer, at total expense per day of 24 hours of $19.50. On 8-hour shifts, from 7 a. m. to 3 p. m., one head fireman, one second fireman, and two coal passers were employed; and on each of the other two shifts one head fireman, one second fireman, and one coal passer were employed, at a total expense per day of 24 hours of $19.12, or 38 cents less per day of 24 hours divided into three 8-hour shifts, despite the increased wages per hour.

It must be understood that the conditions existing in the open-hearth department of a steel foundry are in several important respects quite different from those in the typical large steel mill. Therefore the success of the 8-hour system in a steel foundry would not necessarily indicate an equal degree of success in a steel mill. The number of men ordinarily working 12 hours a day in the steel foundry is usually relatively small, the open-hearth furnaces are of comparatively small size, and the methods of casting are very different. Furthermore, the conditions as regards composition and quality of steel are generally somewhat more exacting in the steel foundry than in the steel mill. Generally speaking, however, all of these differences in conditions, except for the more stringent requirements for exact composition and quality, are obstacles to the success of the 8-hour system in the steel foundry as compared with the steel mill. The trial of the 8-hour system in the steel foundry shows that the chief immediate results are secured through the fact that the men work together better and give much closer attention to their work when working 8 hours than when working 12 hours a day.

It may be noted also that none of the workmen in the open-hearth department of the Commonwealth Steel Co. was paid on a tonnage basis, so that there was no direct incentive for increasing production. In the open-hearth departments of the large steel mills, however, the men who control the speed of production (the charging-machine operators and first helpers) are nearly always paid on a tonnage basis, while the melter frequently receives a bonus for large outputs.

It would seem to follow, therefore, that better results even than those described above would be secured by the trial of the 8-hour system in the open-hearth departments of the large steel mills.

Finally, it may be said that the open-hearth department offers fewer opportunities for increased efficiency through the 8-hour system than any other part of the steel mill. There is much less demand for concentrated attention, perfect coordination, and absolute regularity in the operation of open-hearth furnaces than in the operation of the blast furnaces, the Bessemer converters, or the various rolling mills.

CHAPTER VI.

OVERTIME WORK.

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INTRODUCTION.

The strike at the Bethlehem Steel Works (February, 1910), the last important strike in the iron and steel industry,[1] grew out of the large amount of overtime and extra Sunday work which the employees were called upon to perform without any compensation above the regular hourly and piece rates. It is, therefore, of great significance in the present study to inquire how far similar conditions existed at about the same time in other plants in the iron and steel industry.

FREQUENCY AND AMOUNT OF OVERTIME WORK.

It was found to be impracticable to make a study of overtime work for all the plants covered by this investigation, not only because of the great amount of work involved but because in many plants accurate data were not available upon which such a study could be based. The study was accordingly limited to nine large plants with a total of 38,000 employees. These nine plants were widely distributed, five of them being Steel Corporation plants and four the plants of large independent companies. The data used in this study cover for each plant the pay-roll period from May 16 to 31, inclusive. This period, while one of full activity in each of the plants selected, did not represent an extraordinary situation so far as overtime work was concerned. In the first place, by the middle of May the rate of production, which had been unusually high during the first four months of the year, was already beginning to decrease rapidly; in the second place, the president of the Steel Corporation had in March ordered that extra Sunday work be reduced to the lowest possible point, and by May the various plants had had full opportunity to carry the orders into effect. The conditions shown here may, therefore, be regarded as those normally existing in large plants during periods of full activity. The facts with regard to overtime work are summarized in the following table, which shows for the various departments in the nine plants under consideration the per cent of employees working overtime and the per cent which overtime was of the regular working hours. The employees directly engaged in the production of iron and steel are shown separately from the so-called nonproductive employees, whose duties consist largely of furnishing power, making repairs of various kinds, and shipping the products of the plant.

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[1] For an account of the Bethlehem strike see Report on Strike at Bethlehem Steel Works, South Bethlehem, Pa., S. Doc. No. 521, 61st Cong., 2d sess.

PER CENT OF EMPLOYEES WORKING OVERTIME IN NINE LARGE PLANTS AND PER CENT WHICH OVERTIME IS OF REGULAR FULL TIME, IN PRODUCTIVE AND IN NONPRODUCTIVE OCCUPATIONS, MAY 16 TO 31, 1910, BY DEPARTMENTS.

Departments.	Total number of employees.		Per cent of employees working overtime.		Per cent which overtime is of regular full time.	
	Productive.	Nonproductive.	Productive.	Nonproductive.	Productive.	Nonproductive.
Blast furnaces	3,527	1,757	6.7	23.4	5.8	7.1
Bessemer converters	1,397	235	23.5	52.3	9.4	8.9
Open-hearth furnaces	4,075	780	29.1	43.7	9.9	8.5
Rolling mills, mechanical	6,554	1,279	26.5	38.7	7.3	10.3
Rolling mills, hand	1,617	98	15.2	27.6	4.1	5.5
Power, mechanical, and yard force:						
Steam, gas, and water	....	1,579	....	24.6	....	8.7
Yard and transportation	....	5,212	....	36.8	....	8.4
Electric power and repairs	....	1,048	....	41.7	....	7.0
Shops	....	5,818	....	41.8	....	9.1
Mechanical repairs	....	1,046	....	58.1	....	9.9
Shipping	....	1,521	....	17.8	....	8.2
Miscellaneous	....	438	....	18.7	....	6.0
Total	17,170	20,811	21.7	36.2	8.0	8.7

It will be noted that the above table includes every department and every workman within the plants, and not simply the shops and the repair department as in the Bethlehem report.[1] Of the 17,170 employees directly concerned with production, 21.7 per cent worked overtime during some part of the half month from May 16 to 31, inclusive. For those employees working overtime the amount of overtime worked was equal to 8 per cent of their regular working schedule for the same period. Of the 20,811 employees in nonproductive occupations, 36.2 per cent did some overtime work during the period, amounting in all to 8.7 per cent of their regular working schedule. More than half of the nonproductive employees in the Bessemer converters and in the mechanical repair department did some overtime work during the 16 days under consideration. The productive employees in the blast-furnace department constituted the only group in which less than 10 per cent worked overtime.

In the report on the strike at the Bethlehem Steel Works it is shown that in the shops and repair departments during each of the months, December, 1909, and January, 1910, about 50 per cent of the employees did some overtime work. During the half month considered in the above table it is shown that 41.8 per cent of the employees in the shops of the nine plants investigated worked overtime to the amount of 9.1 per cent of their regular working schedule.

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[1] Report on Strike at Bethlehem Steel Works, South Bethlehem, Pa., S. Doc. No. 521, 61st Cong., 2d sess., p. 14.

Since the period under consideration was only half as long as that in the Bethlehem report, it is probable that as large a proportion of employees in other large steel plants were working overtime as in the Bethlehem Steel Works. The average amount of overtime per workman, however, was much less than in the Bethlehem Steel Works. Reducing the figures for the Bethlehem plant to the basis of the half month used in the present investigation, it is found that the employees in the shops at Bethlehem who worked overtime averaged about 27 hours in a half month, while the employees who worked overtime in the shops of the nine plants under consideration averaged 13.1 hours. The average of 13.1 hours for these plants is, however, equivalent to slightly more than 6 hours of overtime per man per week.

The average amount of overtime varied considerably in the different departments. The following table shows for the employees in the productive occupations the average amount of overtime worked in each department and also the average regular time for the overtime workers during the period under consideration:

EMPLOYEES WORKING OVERTIME AND AMOUNT OF OVERTIME WORKED IN NINE LARGE PLANTS FROM MAY 16 TO 31, 1910—PRODUCTIVE OCCUPATIONS.

Departments.	Total number of employees.	Employees working overtime.		Average hours regular full time for overtime workers.	Average hours of overtime worked.	Per cent which overtime is of regular full time.
		Number.	Per cent.			
Blast furnaces	3,527	236	6.7	152.2	8.8	5.8
Bessemer converters	1,397	328	23.5	161.4	15.1	9.4
Open-hearth furnaces	4,075	1,186	29.1	164.6	16.3	9.9
Rolling mills, mechanical	6,554	1,738	26.5	164.3	12.0	7.3
Rolling mills, hand	1,617	246	15.2	169.9	7.0	4.1
Total	17,170	3,734	21.7	163.8	13.1	8.0

The open-hearth department shows not only the largest proportion of employees working overtime, but also the highest average amount of overtime per employee. The overtime in this department is equal to approximately 10 per cent of the regular working time during the period. Reduced to a weekly basis, the average regular working time for these employees equaled 72 hours per week, and the addition of 7 hours of overtime consequently made a very long working schedule. In the mechanical rolling mills and the Bessemer converters the conditions were not far different. In the hand rolling mills and the blast furnaces not only was there a smaller proportion of employees who worked overtime, but the overtime work amounted to much less for each of the employees. It may be noted also that the employees in the blast furnaces who worked overtime were largely those whose normal working schedule was decidedly below that of the majority of the workers in the department. The regular full time for 7-day workers during the 16 days amounted to 192 hours, while the regular full time for the overtime workers was 152 hours. A very large number of the overtime workers were stockers and general laborers engaged in handling materials, who worked 10 or 11 hours per day for 6 days per week. The overtime in this department is practically limited to this class of workers, since those who work 12 hours per day for 7 days per week have little opportunity for working overtime except when they take the places of the men on the opposite shift and work the full turn.

Similarly, a study of the employees in nonproductive occupations can be made from the following table:

EMPLOYEES WORKING OVERTIME AND AMOUNT OF OVERTIME WORKED IN NINE LARGE PLANTS FROM MAY 16 TO 31, 1910—NONPRODUCTIVE OCCUPATIONS.

Departments.	Total number of employees.	Employees working overtime.		Average hours regular full time for overtime workers.	Average hours of overtime worked.	Per cent which overtime is of regular full time.
		Number.	Per cent.			
Blast furnaces	1,757	412	23.4	141.1	10.0	7.1
Bessemer converters	235	123	52.3	163.4	14.5	8.9
Open-hearth furnaces	780	341	43.7	169.8	14.4	8.5
Rolling mills, mechanical	1,279	495	38.7	169.3	17.5	10.3
Rolling mills, hand	98	27	27.6	176.7	9.6	5.5
Power, mechanical, and yard force:						
Steam, gas, and water	1,579	389	24.6	165.9	14.4	8.7
Yard and transportation	5,212	1,917	36.8	155.4	13.1	8.4
Electric power and repairs	1,048	437	41.7	152.6	10.7	7.0
Shops	5,818	2,430	41.8	143.6	13.1	9.1
Mechanical repairs	1,046	608	58.1	156.9	15.6	9.9
Shipping	1,521	270	17.8	164.3	13.5	8.2
Miscellaneous	438	82	18.7	168.1	10.0	6.0
Total	20,811	7,531	36.2	153.5	13.4	8.7

It will be noted that in each of the departments more than 15 per cent of the employees in nonproductive occupations worked overtime and that in all but one department the overtime per employee amounted to 10 or more hours during the period. The worst conditions as regards overtime are shown for the mechanical rolling mills, where 38.7 per cent of the employees worked overtime, averaging 17.5 hours of overtime during the period. As the regular working time of the employees in this department averaged 74.1 hours per week, the addition of 7.7 hours of overtime per week made the actual working time of these employees 81.8 hours, which is almost equivalent to 12 hours per day for 7 days per week.

OVERTIME WORK ON SUNDAY.

The overtime work reported for the plants now under consideration was in large part performed on Sunday. The following table distributes the overtime workers according as their overtime work had been done on Sunday or on week days:

DISTRIBUTION IN NINE LARGE PLANTS OF OVERTIME WORK BETWEEN SUNDAY AND WEEK DAYS.

Departments.	Percentage of overtime work performed by—			
	Employees in productive occupations.		Employees in nonproductive occupations.	
	Sunday.	Week days.	Sunday.	Week days.
Blast furnaces	61.8	38.2	58.3	41.7
Bessemer converters	67.5	32.5	59.5	40.5
Open-hearth furnaces	83.7	16.3	83.2	16.8
Rolling mills, mechanical	68.2	31.8	80.2	19.8
Rolling mills, hand	63.5	36.5	23.1	76.9
Power, mechanical, and yard force:				
Steam, gas, and water	....	....	87.1	12.9
Yard and transportation	....	....	58.4	41.6
Electric power and repairs	....	....	57.6	42.4
Shops	....	....	39.4	60.6
Mechanical repairs	....	....	33.3	66.7
Shipping	....	....	49.8	50.2
Miscellaneous	....	....	33.5	66.5
Total	73.8	26.2	54.1	45.9

It will be seen that about three-fourths of the overtime work for employees in productive occupations consisted in working on Sunday, while for the nonproductive employees, who were for the most part men making repairs of various kinds, only a little more than one-half of the overtime was performed on Sunday. The overtime work on Sunday consists of two different classes of work—first, the operation of the department for one or more additional turns on Sunday, and, second, extensive repairs and rebuilding operations, which sometimes require the whole of Sunday to complete. In the open-hearth department, for example, two of the plants under consideration operated two extra Sunday turns during the period under consideration, thus giving each employee in the department 24 hours of overtime on Sunday. One of the plants included regularly operated its open-hearth furnaces, Bessemer converters, and rolling mills 7 days per week throughout the greater part of the year 1910. Sunday work for the employees in this establishment was not counted as overtime work except for the small number of employees who had a regular working schedule of only 6 days per week. This particular plant, it may be noted, had a much larger proportion of employees working 7 days per week than did the Bethlehem Steel Works at the time of the strike.

PAYMENT FOR OVERTIME WORK.

For the nine plants under consideration absolutely no payments are made for overtime in addition to the regular rates of wages. As a matter of fact, the tonnage men when required to work overtime on repairs receive an hourly rate which is very much less than the average amount which they receive when working on tonnage. This applies particularly to the employees in the rolling mills. Similarly, the foremen and other salaried employees not only do not receive extra compensation for overtime work, but are expected to work whenever they are needed at their regular monthly compensation. Even the machinists, bricklayers, and other artisans, who throughout their trades generally are paid at the rate of time and a half for overtime and double time on Sundays, receive in all of the plants under consideration only the regular time rate.

The same situation exists in most of the other large steel plants throughout the country, although there are a few in which the machinists, bricklayers, and others in similar trades receive some additional compensation for overtime work above their regular rate of pay. In the open-hearth department there is one plant of moderate size in which all the productive employees are paid twice the regular rate whenever they are called upon to perform any overtime work. There is also one very small open-hearth plant in which the melters' helpers and chargers receive 25 per cent above the regular rate for overtime work. Altogether, however, there are only 132 employees out of a total force of 14,618 in the open-hearth department who receive any compensation in addition to their regular wages for overtime work. In the blast furnaces only 149 out of 31,321 employees receive any rate higher than their regular wage for overtime work. In the power, mechanical, and yard force, where there is a relatively large proportion of highly skilled workmen who are well organized outside of the steel industry, a much larger proportion of the employees are paid extra rates for overtime work. The situation for this class of employees is shown in the following table:

NUMBER AND PER CENT OF EMPLOYEES IN THE POWER, MECHANICAL, AND YARD FORCE RECEIVING OTHER THAN THE REGULAR RATE FOR OVERTIME WORK, BY DISTRICTS.

Districts.	Total number of employees.	Number paid extra rate for overtime work.			Per cent paid extra rate for overtime work.		
		50 per cent above regular rate.	25 per cent above regular rate.	Other amounts above regular rate.	50 per cent above regular rate.	25 per cent above regular rate.	Other amounts above regular rate.
New England	1,319	47	59		3.6	4.5	
Eastern	7,365	751	1,008	62	10.2	13.7	0.8
Pittsburgh	34,955	502	35	6	1.4	.1	(1)
Great Lakes and Middle West	18,655	460	645	6	2.5	3.5	(1)
Southern	3,364	88			2.6		
Total	65,658	1,848	1,747	74	2.8	2.7	.1

[1] Less than one-tenth of 1 per cent.

With few exceptions all the employees noted in the above table as receiving extra compensation for overtime work are employed by what are classed in this report as "small companies." As the large companies largely determine the working conditions in the industry, this fact is of significance. Only two of the large companies recognize any organizations of labor, and none of the large companies have recognized the propriety of paying their unorganized workmen at a higher rate when they are called upon to perform overtime work. This fact alone is sufficient to account for much of the overtime work that is to be found in the industry. As matters stand there is no incentive for the superintendent or foreman to cut down the amount of overtime work done under his direction, since overtime work if paid at the regular time rate does not increase the cost of production.

EXTREME CASES OF OVERTIME WORK.

In order to show what this overtime work may amount to in extreme cases, an interview with a millwright foreman may be cited:

> The hours in this department (mechanical repair) are 10 per day—there is only one shift. The men receive the regular rate for overtime, but the foreman does not receive any extra pay for overtime, although he is "docked" for any short time. The men in this department are not satisfied, because in 1907 their hours were cut from 12 to 10 and the night shift was abolished. The men are now expected to do nearly as much in 10 hours as was formerly done in 12 hours. Moreover, the pay earned by most of them makes it almost impossible to live on what they earn in 10 hours. This makes them glad to get the overtime work even when paid at regular time rate. When about to work overtime—which is compulsory—they are often notified the day before and are expected to bring along enough food to last for two shifts. The superintendent discourages their going out to get anything warm to eat. I worked last week all day Thursday and Thursday night and Friday until 7 p. m. without stopping and without any warm food. I went back on the job Saturday and worked 12 hours; but slept Saturday night and all day Sunday, I was so tired.

Another flagrant case of overtime work may be cited at one of the southern blast furnaces which was reported as follows in the notes of the Bureau's agent:

> Overtime work among the "turn men" at the ——— furnaces is quite usual. This overtime consists of working an extra shift and is known as "doubling back." When a day man "doubles back," he works on the night force after a day of work. If he then continues to work the following day, he works 36 hours continuously, and this is not unusual. The men who "double back" are, as a rule, men who have frequent periods of rest, and who can, therefore, sleep while on duty, but this is not true in all cases. One skip-hoist man was interviewed, however, who said he has sometimes worked two 18-hour shifts in succession and sometimes 48 hours continuously. Skip-hoist men have but little leisure, and they can not leave their posts.

During the week preceding the agent's visit W—— H——, a sandman, said that he was on duty continuously from 3.30 p. m. on Friday until Monday at 6 p. m. He said he usually slept from about 10 p. m. to 3 or 4 a. m. The other members of his crew, he said, had worked most of the week both night and day. S—— L——, a trough man, said that the week preceding the agent's visit he worked the equivalent of 15 shifts between Friday at 6 p. m. to Saturday noon of the following week. He was on duty all of the time except Wednesday night; part of the time he did one-half of a sand cutter's work in addition to his own work, and from Friday night to Saturday noon he did two men's work, getting credit for three days. One week in September he said he worked continuously night and day. A fellow workman said that he understood that on September 24 L—— had put in 26 extra days during the month, some of them, necessarily, by doing double duty as well as working both night and day. L—— himself thought he had a few less than 26 extra days. This man's occupation is preparing the trough through which the iron runs from the furnace to the runway. Careful inquiry was made as to the time he actually works. When on day turn he is busy, he says, from 6 to 9 a. m. and from 3 to 4.30 p. m. At night he works from 4 to 6 p. m., from 9 to 11 p. m., and from 3 a. m. to 4.30 p. m.

There is no reason to doubt the story which this man tells of continuous employment. What he says is only corroborative of what was reported concerning him by several other employees. Neither is his case unusual, except in the large amount of overtime work done. Continuous periods of 36, 48, and 60 hours of employment are fairly usual at the ——— furnaces. This overtime work is requested by the foreman, but is not required. L——, the man reported upon above, says that he does this large amount of work because he wishes to dress well, "like white folks," and that he can't do it without working overtime. For his labor night and day he receives from $65 to $70 per month. All of the men interviewed said that they were free to decline to work overtime if they cared to do so, and many always refuse.

It should be remembered, however, that the men are also free to decline to work on their regular turn. According to the superintendent, some of them do not work more than two-thirds of the time. There can be no doubt that when a foreman comes to a man and asks him to "help out" he feels under some compulsion to comply. An intelligent white man, a machinist and a former employee, explained that the men fear to court the disfavor of the foreman by declining to work overtime when requested. It may cause them no immediate disadvantage, but it might do so in case of curtailment. A colored employee said that inasmuch as the superintendent always treated them well, they wanted to help him if necessary. To refer again to L——, when the agent called upon him at noon on Saturday after he had worked 15 days in a week and 18 hours, he was dressed in his $30 suit and about to hurry away for the afternoon, for the purpose, as he stated, of being absent when the foreman sent for him to come and work. He was certain, he said, that he would be called upon to work that afternoon.

It may be noted that all this overtime work is paid for at the regular rate.

CHAPTER VII.

IRREGULARITY OF EMPLOYMENT.

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IRREGULARITY OF EMPLOYMENT.

INTRODUCTION.

In interviews with workmen during the course of this investigation many complaints were made with regard to the working conditions in the iron and steel industry,[1] but there was no complaint so frequently made or so strongly expressed as that regarding irregularity of employment. There were many points on which the workmen did not agree; many complained of the long hours, others wished no change in the hours of labor; many complained of low wages, others felt they were being paid at a fair rate; but in all parts of the country and in all occupations practically all of the workmen interviewed considered questions affecting hours of labor and rates of wages of less importance than the constantly recurring periods of unemployment and the uncertainty which attended the work at all times. Even when the mills were running at full capacity there was still the uncertainty as to how much longer the boom would last and when the mills would be shut down or operated only half time.

The irregularity of work and the frequent unemployment is objected to by the workmen, not only because it greatly reduces the amount of their annual income, but also because it is impossible in times of prosperity to tell upon what scale expenditures should be made in order to provide a fund out of which a family can be supported during periods of idleness.

Furthermore, such irregularity of work conduces to frequent moving from locality to locality in the hope that some time a position

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[1] In 1909 the steel works and rolling mills had relatively the largest fluctuation in the size of the labor force of any of the large manufacturing industries. This is shown in the following table, drawn from the Abstract of Statistics of Manufactures of the United States (Bulletin of the Bureau of the Census), 1910, p. 22:

Industries.	Per cent of minimum on maximum number of employees.	Industries.	Per cent of minimum on maximum number of employees.
Steel works and rolling mills	75.8	Tobacco manufactures	91.6
Foundry and machine-shop products	80.7	Clothing, men's, including shirts	91.8
Lumber and timber products	87.8	Boots and shoes	91.8
Car building and repairs	89.1	Printing and publishing	93.3
Woolen, worsted, and felt goods, and wool hats	91.0	Cotton goods	97.6

affording steady employment will be obtained. In the case of men with families the movement from town to town means not only a considerable expenditure for railroad fares, but also a great deal of expense incident to settling in a new home. Frequently debts are incurred at the time of going to the new town which prevent the workman from regaining his independence.

It should be understood in considering the prevalence of these complaints that the principal part of the field work for this investigation was made during 1910, when the production of iron and steel was greater than in any preceding year. From January until May, 1910, practically every furnace and steel works in the United States was operated to its full capacity and many were making a great deal of overtime and operating their steel works and rolling mills 7 days a week. From May until the end of the year the production gradually declined, but until November the daily production of pig iron was very little below 70,000 tons, which is the average daily output for three years—1909 to 1911—and may be considered as about the normal demand of the United States for pig iron at the present time.

During 1911 the average daily production fluctuated between 56,000 and 70,000 tons per day, the average for the year being 63,887. During the two years over which the field work of the present investigation extended the total production was at least as large as could have been expected and yet, at the same time, complaint was heard from all classes of employees, skilled and unskilled, native and immigrant, of the irregularity and uncertainty of employment in the iron and steel industry.

This striking situation in which there are complaints as to the uncertainty and irregularity of work during a period of fair prosperity is, in large degree, the natural result of the business policies followed in the industry. As is fully explained in Chapter XIV, it is a fixed and characteristic policy of the iron and steel industry to operate each producing unit to its fullest capacity and for the maximum number of working hours during a period of active demand, and then as soon as there is a decline in the market to shut down completely and wait an accumulation of orders or the development of better prices. The causes of this policy and its effects upon the workmen and upon the productive efficiency of the industry are fully discussed elsewhere.[1]

The extent of the fluctuation in the iron and steel production during several years, and of the resultant irregularity in employment, are considered in the remaining pages of this chapter. The precise effect of such fluctuations upon the annual earnings of the workmen is separately shown in the next chapter.

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[1] See p. 379.

FLUCTUATIONS IN PIG-IRON PRODUCTION.

Since pig iron forms the fundamental material for all other branches of the iron and steel industry, and also because large stocks of pig iron are seldom kept, the production figures for blast furnaces indicate with a fair degree of precision the amount of activity in the industry as a whole from month to month. The following table shows the average daily production per month during each of the five years, 1907 to 1911:

AVERAGE DAILY OUTPUT PER MONTH, IN GROSS TONS, OF COKE AND ANTHRACITE PIG IRON IN THE UNITED STATES, 1907 TO 1911.

[From the Iron Age, Jan. 11, 1912, p. 149.]

Months.	1907	1908	1909	1910	1911
January	71,149	33,918	57,975	84,148	56,752
February	73,038	37,163	60,976	85,616	64,090
March	71,821	39,619	59,232	84,459	70,036
April	73,885	38,289	57,962	82,792	68,836
May	74,048	37,603	60,753	77,102	61,079
June	74,488	36,444	64,656	75,516	59,585
July	72,763	39,287	67,793	69,305	57,841
August	72.594	43,851	72,546	67,963	62,150
September	72,783	47,300	79,507	68,476	65,903
October	75,383	50,554	83,856	67,520	67,811
November	60,937	51,595	84,917	63,659	66,648
December	39,815	56,158	85,022	57,349	65,912

During the past five years it will be seen that the average daily production has varied from 33,918 tons in January, 1908, to 85,616 tons in February, 1910. The average daily production during the month of greatest activity was, therefore, more than 2½ times as great as during the month of depression. Furthermore, in each year except 1911 the production of pig iron in the month of greatest activity was approximately 1½ times as great as the production during one or more months of comparative depression, and even in 1911 the rate of production in March was almost 25 per cent higher than in January. Furthermore, from month to month the variation is considerable. For example, in 1911 the rate of production increased from January to February by about 7,300 tons and from February to March by approximately 6,000 tons. In April the rate of production fell off 1,200 tons and in May almost 8,000 tons. During each of the other months, except November and December, there was a decline or advance in the rate of production amounting to 1,400 tons or more per day.

FLUCTUATIONS IN EMPLOYMENT IN BLAST FURNACES, 1907 TO 1911.

The significance of the fluctuations in production will be seen when it is understood that an advance or decline of 1,000 tons in the daily rate of pig-iron production means a change of more than 500 men in the total number required to operate the blast furnaces. For 1909 the average output per man per day for the blast furnaces of the country, as determined from the statistics of the Bureau of the Census, amounted to approximately 1.829 tons. The following table shows the approximate number of workmen employed in the blast furnaces during each month of the five years, 1907 to 1911.

The figures in this table are obtained by dividing the average daily pig-iron production shown in the table on page 207 by the average output of 1.829 tons per man per day. It should be clearly understood that these figures are presented only as rough approximations, since variations may be produced by any one of several causes: (1) The most inefficient furnaces are the ones which are first put out of blast or banked, consequently in times of depression the average output per man per day is higher than in times of full operation. The figures shown in the following table are, therefore, very conservative as regards the number of men laid off during months of depression. (2) There are seasonal variations, due to climatic causes, but for the country as a whole they would have very little effect on the figures shown. (3) When a furnace is first put into blast its output is likely to be low for several days until the furnace is working smoothly. During periods of recovery from depression, therefore, the number of men will actually be increased somewhat more rapidly than is shown in the table.

APPROXIMATE AVERAGE NUMBER OF MEN EMPLOYED IN BLAST FURNACES, EACH MONTH, 1907 TO 1911.

[Computed from average daily output of pig iron on basis of 1.829 tons per man per day.]

Months.	1907	1908	1909	1910	1911
January	38,900	18,545	31,698	46,008	31,029
February	39,933	20,319	33,338	46,810	35,041
March	39,268	21,662	32,385	46,178	38,292
April	40,396	20,934	31,691	45,266	37,636
May	40,486	20,559	33,217	42,155	33,395
June	40,725	19,926	35,350	41,288	32,578
July	39,783	21,480	37,066	37,892	31,624
August	39,691	23,975	39,664	37,159	33,980
September	39,794	25,861	43,470	37,439	36,082
October	41,217	27,640	45,848	36,916	37,075
November	33,317	28,209	46,428	34,805	36,440
December	21,769	30,704	46,486	31,355	36,037

The approximate number of employees in the blast furnaces ranged from 18,545 in January, 1908, to 46,810 in February, 1910. From October, 1907, to December of that year approximately 20,000 employees were laid off following the panic of 1907. Complete recovery from the depression was not reached until August, 1909. The 12 months following were the most prosperous in the history of the industry and a labor force of 46,000 men was built up to handle the blast furnaces of the country. By the end of the year 1910, however, 15,000 of these men had been laid off and not more than 7.000 were taken on during 1911. These great fluctuations are in large measure the direct result of certain features of the general financial and economic situation with which this discussion is in nowise concerned.

Of still more importance in such a study as this are the smaller fluctuations which occur from month to month, and which are in large part due to the attempts of the blast furnace operators to anticipate the market and avoid creating large stocks of pig iron by blowing out or banking their furnaces "in the nick of time." While for the reasons mentioned above the monthly fluctuations in the labor force shown in the preceding table can not be considered as absolutely accurate, they are sufficiently approximate to indicate that for 49 of the 60 months shown in the table there were variations, from month to month, in the number of men on the pay rolls amounting to 500 or more employees.

In 31 of the 60 months these fluctuations amounted to 1,000 or more employees, and in several other cases they were only 100 short of that number. In more than one-half of the months from 1907 to 1911, inclusive, therefore, 1,000 men were being taken on or discharged from the labor force for the blast furnaces alone. Furthermore, these men were uncertain whether at the time they were hired they would have 1 month or 6 months of steady work, and when they were discharged there was equal uncertainty whether they would be out of work for only a few weeks or for as many months.

Such a condition can exist only in an industry where productive capacity has been enlarged until it far surpasses the normal demand, and where a large amount of equipment is allowed to remain idle a large part of the time to be ready to reap large profits during a short period of high prices.

Equipment and capacity for producing iron and steel have in recent years been greatly enlarged, so that at the present time (1912) the capacity is nearly 50 per cent greater than the previous maximum demand. In 1912 there is in the United States a productive capacity for pig iron of 40,000,000[1] tons a year while the maximum demand in any previous year (1910) was 27,300,000 tons. The blast furnaces of 1912 running at full capacity could, therefore, produce all the tonnage of 1910 in 8 months and be shut down completely for the other 4 months of the year.

This condition can not be justified on the ground that this overcapacity is necessary to meet seasonal demands. The iron and steel industry is not to any considerable degree a seasonal industry. To some extent, the industry is affected by the fact that building operations are largely begun in the early spring and that track work on the railroads is a summer operation. The heaviest demands for rails and for structural steel are, therefore, for spring and summer deliveries. To a somewhat greater extent also the canning season affects the production of tin plate. As a whole, however, the effect from seasonal operations is very slight, especially as compared with a large number of other industries. If seasonal operations alone were the chief causes of unemployment, the workmen would be much better off for they would then know what to expect. As it is, they do not know more than a week or two ahead when operations will slow down or cease altogether.

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[1] Testimony of J. A. Farrell, in Hearings before House Committee on Investigation of United States Steel Corporation, p. 265.

FLUCTUATIONS IN EMPLOYMENT IN STEEL WORKS AND ROLLING MILLS.

Considering the iron and steel industry as a whole the fluctuations in employment were much greater than is indicated by the figures for the blast furnaces alone. This is due to the fact that in times of depression or of slack demand the rolling mills and steel works are likely to be shut down before any great decrease is made in the blast-furnace production. There are no figures available by which the fluctuations of employment in the steel works and rolling mills can be shown for the country as a whole. However, sufficient idea of the frequency and extent of such fluctuations can be gained from a study of the statistics of employment in a single large plant. For this plant data are available showing for each month from 1905 to 1910, inclusive, the average number of men employed in each department and in the plant as a whole. These figures are shown in the table which follows and clearly illustrate the great fluctuations which occurred in the plant from month to month. Furthermore, it should be said that this plant has a reputation throughout the industry of being one of the most constant in its operation and of suffering less from periods of depression than most of the large steel plants.

AVERAGE NUMBER OF EMPLOYEES IN EACH DEPARTMENT OF A SINGLE LARGE PLANT DURING EACH MONTH, 1905 TO 1910.

Years and months.	Blast furnaces.	Converting works and open hearth.	Rolling mills.	Mechanical, electrical, and foundry.	Docks, yards, and miscellaneous.	Total.
1905.						
January	912	590	1,059	1,278	1,451	5,290
February	1,113	743	1,234	1,366	1,603	6,059
March	1,100	760	1,283	1,305	1,710	6,158
April	1,055	742	1,236	1,355	1,454	5,842
May	1,005	771	1,316	1,336	1,841	6,269
June	930	757	1,325	1,331	1,832	6,175
July	910	726	1,239	1,240	1,790	5,905
August	904	782	1,336	1,362	2,005	6,389
September	935	760	1,261	1,548	2,115	6,619
October	866	765	1,272	1,622	2,395	6,920
November	867	741	1,438	1,428	1,706	6,180
December	930	746	1,389	1,805	2,282	7,152

AVERAGE NUMBER OF EMPLOYEES IN EACH DEPARTMENT OF A SINGLE LARGE PLANT DURING EACH MONTH, 1906 TO 1910—Concluded.

Years and months.	Blast furnaces.	Converting works and open hearth.	Rolling mills.	Mechanical, electrical, and foundry.	Docks, yards, and miscellaneous.	Total.
1906.						
January	1,079	806	1,585	1,957	2,000	7,427
February	1,080	798	1,570	2,088	1,825	7,361
March	1,342	838	1,691	1,869	2,015	7,755
April	1,322	868	1,700	1,554	1,849	7,293
May	1,365	921	1,719	1,477	2,299	7,781
June	1,384	965	1,670	1,517	2,119	7,655
July	1,305	1,017	1,658	1,379	1,906	7,325
August	1,343	1,099	1,706	1,545	1,917	7,610
September	1,368	1,092	1,704	1,391	1,836	7,391
October	1,093	1,235	1,736	1,354	1,607	7,025
November	1,227	1,081	1,790	1,509	1,699	7,306
December	1,179	1,041	1,750	1,386	1,629	6,985
1907.						
January	1,224	1,111	1,732	1,499	1,630	7,196
February	1,247	1,149	1,805	1,575	1,735	7,511
March	1,282	1,104	1,755	1,707	1,788	7,636
April	1,302	1,214	1,736	1,600	1,757	7,609
May	1,262	1,166	1,895	1,665	1,947	7,935
June	1,175	1,140	1,827	1,697	1,949	7,788
July	1,168	1,152	1,860	1,694	1,815	7,689
August	1,168	1,256	1,979	1,754	1,797	7,954
September	1,195	1,305	1,897	1,729	1,709	7,835
October	1,195	1,363	2,072	1,847	1,426	7,903
November	1,004	1,226	2,009	1,555	1,484	7,278
December	900	919	1,721	1,245	1,185	5,970
1908.						
January	1,115	668	1,197	1,333	1,136	5,449
February	1,191	485	883	1,038	1,137	4,734
March	1,210	470	1,261	1,231	961	5,133
April	1,106	426	1,081	1,045	911	4,569
May	1,020	431	1,130	948	836	4,365
June	1,006	438	1,168	1,007	757	4,376
July	936	443	1,195	968	904	4,446
August	906	426	1,000	916	840	4,088
September	849	526	1,169	944	847	4,335
October	847	585	1,223	1,000	871	4,526
November	842	646	1,234	1,031	849	4,602
December	883	778	1,374	1,076	705	4,816
1909.						
January	937	707	1,167	1,108	770	4,689
February	1,138	811	1,442	1,127	846	5,364
March	1,161	879	1,469	1,209	919	5,637
April	1,015	921	1,567	1,248	943	5,694
May	1,117	937	1,749	1,262	879	5,944
June	1,229	972	1,890	1,315	1,010	6,416
July	1,177	1,022	1,902	1,325	1,067	6,493
August	1,148	965	1,975	1,388	1,117	6,593
September	1,100	1,060	2,023	1,358	1,098	6,639
October	1,189	1,047	2,078	1,446	1,137	6,897
November	1,211	1,188	2,077	1,508	1,261	7,245
December	1,182	1,103	2,005	1,483	1,197	6,970
1910.						
January	1,212	1,208	2,356	1,768	1,434	7,973
February	1,274	1,192	2,568	1,804	1,409	8,247
March	1,217	1,203	2,526	1,632	1,411	7,989
April	1,125	1,341	2,498	1,786	1,590	8,340
May	1,132	1,283	2,449	1,817	1,676	8,357
June	1,118	1,394	2,364	1,429	1,801	8,106
July	1,062	1,153	2,327	1,644	1,336	7,522
August	1,011	959	2,123	1,573	1,359	7,025
September	953	751	2,293	1,889	1,258	7,144
October	946	706	2,286	1,363	1,125	6,426
November	1,027	708	2,667	1,738	1,054	7,194
December	904	625	2,204	1,649	887	6,269

Considering the six years as a whole, the largest fluctuations occurred in the force employed in connection with the docks, yards, and miscellaneous operations. The smallest fluctuations in the average number of workmen employed occurred in the blast furnaces and rolling mills. In the case of the rolling mills, however, the actual irregularity of employment is very much greater than is indicated by the table. The effect of such irregularity is concealed in the monthly average, because when one rolling mill ceases to operate for a time because of a slack demand another mill producing different products frequently becomes active.

OPPORTUNITIES FOR EMPLOYMENT, 1910.

The fluctuations in the number of employees from month to month and from year to year, as shown with approximate correctness in the above tables, indicate roughly the opportunities which workmen had for employment during the period covered by the data. In order to obtain more complete information on this point a special study was made of the conditions of employment in 1910. As a basis for this study information was obtained from all the plants covered by the investigation as to the number of days or shifts each producing unit was operated during the year.

The reports received covered 90,757 employees in five principal departments, namely, blast furnaces, Bessemer converters, open-hearth furnaces, rolling mills (mechanical), and rolling mills (hand), or about 95 per cent of the 95,050 employees in these five departments for whom weekly earnings are shown.

It was necessary to obtain the operating time of each unit within a plant, rather than that of the plant as a whole, because there were frequently wide variations as to operating time in the different mills or departments. The necessity of this detail is illustrated by the case of one plant in which one rolling-mill unit operated 18.5 weeks, while another operated 38.1 weeks. In another plant one rolling-mill unit operated 23 weeks and another operated 45.9 weeks. This detail could not be obtained for each puddling and each crucible furnace nor for each tube-rolling unit. It was therefore necessary to omit from the present consideration the puddling and crucible department and the tube-mill department. The power, mechanical, and yard force was also omitted for the reason that no adequate data were available which would show the possible working time of the constituent parts of that force.

The operating time of the plant units in the five principal departments was reported in terms of days, turns, or shifts, and these were all converted into weeks.[1] The week was used as the unit of operating time because it represented the only unit which would be uniform for all employees.

The following table shows for each of the five principal departments the distribution of the employees according to the number of weeks their respective plant units operated in 1910:

CLASSIFIED NUMBER OF WEEKS DURING WHICH MILLS OR OTHER DEPARTMENTS OPERATED IN 1910, AND PER CENT OF EMPLOYEES AFFECTED—ALL DISTRICTS.[1]

Classified number of weeks in operation.	Per cent of employees according to operating time in—					
	Blast furnaces.	Bessemer converters.	Open-hearth furnaces.	Rolling mills, mechanical.	Rolling mills, hand.	All departments.
Under 20 weeks	2.0	....	0.2	0.5	1.7	1.2
20 and under 24 weeks	3.1	3.3	1.9	2.7	.7	2.3
24 and under 28 weeks	1.2	3.6	1.6	2.1	2.4	1.9
28 and under 32 weeks	3.3	....	3.0	1.0	3.4	2.5
32 and under 36 weeks	2.5	6.7	2.7	5.0	8.3	4.6
36 and under 40 weeks	8.8	9.2	2.6	10.6	14.3	9.4
40 and under 44 weeks	17.3	11.5	1.7	18.4	18.2	15.0
44 and under 48 weeks	18.0	17.2	29.7	31.3	29.6	25.4
48 weeks and over	43.9	48.4	56.7	28.2	21.2	37.6
Number of employees	30,537	5,510	13,887	22,552	18,271	90,757

[1] The detailed tables of which this is a summary are shown in Appendix I, p. 548.

These figures show that 21.9 per cent of these employees were in plant units that operated less time than 40 weeks in 1910. Less than 40 per cent were in units that operated 48 weeks and over. There were practically as many employees (36.9 per cent) in units operated less than 44 weeks as in those operated 48 weeks and over. In the majority of cases the operating time was not consecutive; that is, the plants were not run continuously for 9 months and then shut down for the remaining three months, but, on the contrary, the more usual condition was for the plants (particularly the rolling mills) to run steadily for a few weeks and then shut down suddenly for an indefinite period which might be a few days or a few weeks. At the time of shutting down the mills, it is usually impossible for the managers to predict how long the cessation of work may continue, but none the less it constitutes a serious hardship on the workmen. Ignorant of whether the shutdown may be long or short, they hesitate to assume the risks of looking elsewhere for work, and frequently during such periods of unemployment assume a mode and standard of living which is not conducive to their own efficiency or to the welfare of the community as a whole.

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[1] In converting the data into weeks, the number of days or turns reported as constituting the standard week in May, 1910, for which wage data were obtained, was used as a basis. For example, if a department was reported as operating 14 shifts per week, the number of standard weeks operated during the year was obtained by dividing the aggregate number of shifts by 14.

Comparing departments, it will be noted that the greatest amount of unemployment was to be found in connection with the rolling mills operated by hand, in which approximately 31 per cent of the employees were in mills which were operated for less than 40 weeks of the year, and only 21.2 per cent were in mills operated for 48 weeks or more. The smallest amount of unemployment was to be found in the open-hearth department.

The effect of the unemployment in the industry as a whole will be better understood when it is noted that instead of calculating the annual earnings of employees in the iron and steel industry on a basis of 52 weeks' employment it is necessary to make allowance for the fact that only 63 per cent were employed for as long as 44 weeks during the year. Furthermore, the above statements do not take into account any time lost through accident or sickness. The available statistics show that considering the steel industry as a whole each employee had an expectation of losing approximately 4 days a year through accidents.[1] A study of the records of a benefit association covering the employees of a large steel plant for a number of years showed an average annual loss of at least 1½ weeks through sickness. Taking these various causes of unavoidable lost time into consideration it seems probable that during a prosperous year like 1910 the average employee does not have an opportunity to work more than 45 weeks during the year, and would therefore lose, through causes over which he could have no control, at least 13 per cent of the total working year. The reports of the Immigration Commission show how during the long periods of depression in the steel industry the families of steel workers are supported on the lowest level of subsistence by the work of the women and children in cigar factories and other so-called "complementary" industries. These industries locate in the steel towns to take advantage of the large supply of woman and child labor which can not be utilized in the steel mills. As these factories are run with relative constancy, and are usually the only other industries in the steel towns which supply an outside market, it is largely through their assistance that the married employees are able to live through the long periods of depression. The unmarried immigrants in such cases leave the country in large numbers.

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[1] See Accidents and Accident Prevention, Vol. IV.

CHAPTER VIII.

ANNUAL EARNINGS AS AFFECTED BY IRREGULAR EMPLOYMENT.

CHAPTER VIII.

ANNUAL EARNINGS AS AFFECTED BY IRREGULAR EMPLOYMENT.

INTRODUCTION.

It is the custom of the iron and steel industry to pay the great majority of its employees in terms of hourly rates, a detailed analysis of which has been made in a preceding volume. These rates form the measure of what the manufacturer pays for labor. The workman's primary interest, however, is not in hourly rates, but in earnings. Two men may be receiving the same hourly rate, but owing to a difference in working hours one may have very much more money in his envelope on pay day than has the other. Such a condition is particularly common in the steel industry, in which the range of customary working hours per week is so wide—roughly from 48 to 84 hours. Over a short period the workman usually measures his earnings in terms of the week, as it is on this basis that he adjusts his immediate expenditures. Ultimately, however, his greatest concern is the possible amount of his annual earnings.

FULL-TIME WEEKLY EARNINGS.

The following table classifies the 172,409[1] iron and steel workers for whom wage data were obtained in this investigation, according to their full-time weekly earnings. In the case of each workman the full-time weekly earnings were obtained by multiplying his hourly rate of pay by the number of hours per week customarily worked in the position filled by him. The result represents the maximum amount which the workman would have obtained per week if he had worked full time. The figures in the table, therefore, may be taken as showing the possibilities for weekly earnings (exclusive of overtime earnings) in the iron and steel industry. It will be noticed that the range of such earnings is comparatively narrow, being between $7.50 and $20 for 85.4 per cent of the workmen. For approximately one-half (49.6 per cent) such earnings were between $10 and $15, and for only 5.3 per cent were earnings of $25 a week a normal possibility.

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[1] See footnote to table on next page.

FULL-TIME WEEKLY EARNINGS OF EMPLOYEES, MAY, 1910—ALL DEPARTMENTS AND DISTRICTS COMBINED.

Full-time weekly earnings.	Employees earning each classified amount per week.	
	Number.	Per cent.
Under $7.50	2,964	1.7
$7.50 and under $10	25,319	14.7
$10 and under $12.50	48,606	28.2
$12.50 and under $15	36,971	21.4
$15 and under $20	36,333	21.1
$20 and under $25	13,104	7.6
$25 and over	9,112	5.3
Total	[1] 172,409	100.0

[1] The number of employees considered in the tables of weekly earnings is somewhat less than the number considered in the tables of hourly earnings shown in Volume I. This is due to the fact that the Pacific Coast district, with 313 employees, was entirely omitted from the weekly-earnings tabulation, and, furthermore, in retabulating the data it was found that in the earlier tabulation of hourly earnings a few items had been omitted or misinterpreted. In each case less than a dozen men were affected out of a total of several thousand.

This table shows, in summary form, the full-time weekly earnings of the entire body of steel workers. For a detailed presentation of weekly earnings, reference may be made to the tables in Appendix J, which show the data separately for each department and district. In these tables the weekly amounts earned are very narrowly classified, and both the number and the per cent of employees who earn the various amounts are shown.

OPPORTUNITIES FOR ANNUAL EARNINGS.

If the several plants of the iron and steel industry operated continuously throughout the year, a study of the earnings of workmen would not have to go beyond the subject of full-time weekly earnings. If the average employee was assured of employment from week to week, the full-time weekly earnings as computed and presented above would indicate fairly the opportunities offered by the industry to its workmen. Such, however, is not the case. As a rule, iron and steel plants do not operate steadily, and the average workman must count upon a "lay off" of several weeks' duration. Usually, as will be explained later, it is very difficult for an iron and steel worker to secure outside employment during such a period of "lay off." Therefore a shutdown by his plant normally means a complete stoppage of his income.

The fact and frequency of irregular employment has been discussed in the preceding chapter. It is the purpose of the following discussion to study the effect of such irregular employment upon annual earnings. From the standpoint of society, as well as of the workman, this is a matter of vital significance.

It was found impracticable to secure and tabulate the actual annual earnings of each individual workman in the industry. Furthermore, the personnel of the labor force changes so frequently that only the data of those employees who were on the pay roll throughout the year would be of value. This would exclude a large part of the common laborers, who shift from plant to plant more frequently than the other employees.

It is practicable, however, to compute with considerable accuracy the total possible earnings which might have been obtained in a given year by employees working under the most favorable conditions, i. e., by employees who, retaining the same working positions, suffered no other losses of time than those imposed by lack of work in the iron and steel industry. Such computations can be made by multiplying the full-time weekly earnings of each of the working positions normally occupied by the number of weeks in operation of the producing unit containing this working position. Thus, if the position of keeper's helper was paid at the rate of $10 per week, full time, and his furnace operated 40 weeks in the year, the limit of annual earnings of this position would be $400. In other words, if one man held this position throughout the period the position was open, working steadily and losing no time through sickness or other disability, his possible earnings would be $400.

The following table shows the results of such computations for practically all the workmen normally employed in the five principal departments of the iron and steel industry in 1910. These departments were: Blast furnaces, Bessemer converters, open-hearth furnaces, hand rolling mills, and mechanical rolling mills. The computations are based on the following data: (1) Full-time weekly earnings of each working position in May, 1910; (2) the number of weeks operated during 1910 by each producing unit of the departments named above.

For reasons explained in a later paragraph, producing units whose total operating time was less than six months are excluded from the table.

Also it should be understood that the computations are based on the rates paid after the general increase in wages, which was made about May 1, 1910. This increase averaged about 6 per cent for the industry as a whole. As the lower rates of wages were in effect for four months of the year 1910, the figures shown here are approximately 2 per cent (one-third of 6 per cent) higher than if correct adjustments were made to allow for this fact.

NUMBER AND PER CENT OF EMPLOYEES IN THE 5 PRINCIPAL DEPARTMENTS HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PLANTS OPERATED 6 MONTHS OR OVER IN 1910.[1]

Classified amount of possible earnings—		Employees having opportunity to earn each classified amount.	
Per annum.	Equivalent per month.	Number.	Per cent.
Under $300	Under $25	1,408	1.6
$300 and under $600	$25 and under $50	36,790	42.5
$600 and under $900	$50 and under $75	33,927	39.2
$900 and under $1,200	$75 and under $100	8,655	10.0
$1,200 and under $1,800	$100 and under $150	4,481	5.2
$1,800 and under $2,500	$150 and under $208⅓	953	1.1
$2,500 and over	$208⅓ and over	381	.4
Total		86,590	100.0

[1] For detailed data on which this table is based see Appendix K, p. 559.

In producing departments which operated 6 months or more during the year, 44.1 per cent of the 86,590 employees had not the opportunity to earn as much as $600 per year in 1910. Almost one-half, therefore, would have averaged less than $12 per week if they had worked every day that employment was offered them in the industry during the prosperous year of 1910. Of the entire force in these departments (and this includes the rollers and other highly paid men in the rolling mills) only one-sixth (16.7 per cent) had an opportunity to earn as much as $900 during the year. A very few employees (1.5 per cent) might have earned $1,800 or more during the year. Almost without exception these highly paid employees were in positions which were almost wholly supervisory, and which demand a high degree of responsibility and trained judgment.[1]

The possible annual earnings of the 86,590 employees averaged approximately $700, but almost two-thirds (63.3 per cent) of the employees earned less than that amount. The median of the possible annual earnings was approximately $630, the wide difference of $70 between the median and the average being caused by the great weight which the very high earnings of $1,800 and over have upon the average.[2]

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[1] As to the skill of these highly paid workmen, the opinion of Mr. Percival Roberts, jr. (a director and formerly a superintendent of the United States Steel Corporation), may be quoted from Hearings before House Committee on Investigation of United States Steel Corporation, p. 3286:

> Mr. YOUNG. It seems to me we used to understand and read about a good many men in the mills getting as high as 10 or 12 or even 15 dollars a day.
>
> Mr. ROBERTS. Not very many. Those were men who were known as rollers, especially what was known as a guide-mill roller. A guide-mill roller is somewhat of a genius. * * * They said a man was never made a guide-mill roller; he was born one. It was due to an extreme skill in changing temperatures, and those men made very high wages.

[2] It may be noted that one employee at $2,500 and over has about 18 times as much effect on the average as one employee at $600 and about 6 times as much effect on the average as one employee at $400. Although there were only 381 men earning $2,500 and over, they had almost as much effect on the average as the 6,772 men earning $300 and under $400.

As previously noted all producing units in operation for less than 6 months[1] were omitted from the above tabulation. This omission was made in order to make the data presented represent as accurately as possible the maximum earnings of iron and steel workers. It has been assumed that persons employed for less than 6 months in the iron and steel industry were able to obtain outside work during the shutdown of their plant, but that persons employed for 6 months or more had no such outside opportunities. This assumption seems reasonably justified by the conditions of employment and of operation in the iron and steel industry. Ordinarily there is little opportunity for workmen to find employment in other iron and steel plants, if the plant in which they are employed shuts down, since the inactivity is usually general. This was especially true in 1910, in which year the irregularity of operation was caused by a definite depression which occurred throughout the industry in the latter part of the year.

Furthermore, it should be noted that when plants lose a month or more during the year, they are seldom shut down continuously during the full period, but are operated intermittently for a week or two at a time whenever orders are secured. Thus, opportunity seldom exists for iron and steel employees to add to their earnings by obtaining work in other industries, for there is always the likelihood that operations will be resumed in the near future, and employees do not feel warranted in accepting other positions even if they are obtainable. Moreover, because the majority of steel plants are located in towns which produce little else besides steel,[2] there is comparatively little work to be had in these localities outside of the iron and steel industry.

OPPORTUNITIES FOR ANNUAL EARNINGS IN THE SEVERAL DEPARTMENTS.

The above statements regarding the opportunities for annual earnings in the iron and steel industry apply to the aggregate of the five principal departments. In the next table the data are presented separately by departments, showing the per cent of employees whose maximum annual earnings fell below specified amounts varying by $100 from $400 to $1,200.[1]

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[1] By operating time is meant the time during which the producing unit offered employment to the entire normal working force. Thus, if a rolling mill was in operation during a week only on the day shift, dividing the work equally between the day and night crews so that each worked only 3 days per week, such a week for purposes of tabulation would be considered equal to only half a week of normal operations.

[2] The Census of Manufactures for 1905 (Pt. I, Chap. XII) shows a high degree of "specialization" in all of the so-called "steel towns," and even in many large cities. A town is said to have "specialized" in a certain industry when a large percentage of the town's entire manufacture consists of articles manufactured by that industry. As examples of a high degree of specialization in the steel industry the following towns and cities may be cited, in which the per cent which iron and steel wage earners are of all wage earners is indicated by the figures after each town: McKeesport, 90.6; Steelton, 95.8; Youngstown, 66.2; Pittsburgh, 45.2.

OPPORTUNITIES FOR ANNUAL EARNINGS OF EMPLOYEES IN PLANTS OPERATED AT LEAST 6 MONTHS DURING THE YEAR, BY DEPARTMENTS, 1910.

Annual earnings.	Per cent of employees whose maximum annual earnings fell below specified amounts.					
	Blast furnaces (28,667 employees).	Bessemer converters (5,327 employees).	Open-hearth furnaces (13,381 employees).	Rolling mills, mechanical (21,580 employees).	Rolling mills, hand (17,635 employees).	Total (86,590 employees).
Under $400	9.1	6.8	5.6	8.1	15.4	9.4
Under $500	24.3	19.8	13.9	21.3	35.0	23.9
Under $600	45.0	40.0	29.9	44.8	53.8	44.1
Under $700	67.9	60.9	52.6	62.5	66.2	63.4
Under $800	84.9	76.6	67.1	73.4	73.4	76.4
Under $900	92.2	83.3	75.1	80.2	78.8	83.3
Under $1,000	95.6	88.2	82.0	85.4	83.5	88.0
Under $1,100	97.8	90.9	86.7	89.1	86.5	91.2
Under $1,200	98.8	93.2	89.8	91.6	89.0	93.3

It is of significance to note that the maximum annual earnings of employees in the various departments are much more nearly on a parity than either the weekly or hourly earnings.[2] This is due to the fact that in establishing the rates of wages in the different departments the probable regularity of employment is taken into consideration. It will be seen, for example, that the maximum annual earnings in the blast-furnace department, while lower than in most of the other departments, are not relatively as low as are the hourly earnings. This arises through the fact that in this department there is a greater tendency for steady operation than in most of the other departments. One of the large steel companies in a communication to the Bureau stated that the hourly rates paid to their blast-furnace employees (very low rates as compared with other departments) were fixed at this level because the blast-furnace employees worked long hours and had almost continuous employment.

On the other hand, maximum annual earnings in the rolling mills are not relatively as high in comparison with those of other departments as are the hourly earnings. Intermittent operation of rolling mills is far more feasible and customary than of any other department and this is especially true of the hand rolling mills, since these mills may be shut down for a week or more with little additional expense.

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[1] The tables shown in this chapter are summaries especially designed to present only the most significant facts. For a very detailed exhibit of the facts regarding opportunities for annual earnings reference should be made to Appendix K, pp. 559–573, which show for each department and district the number and per cent of employees having an opportunity to earn each specified amount. Furthermore, the data are presented in such a way as to show separately departments which were in operation, respectively, 3 and under 6 months, 6 and under 9 months, and 9 months and over.

[2] Hourly earnings, Vol. I, p. xxv; weekly earnings, Vol. III, Appendix J, pp. 550–558.

Below $600 the level of annual earnings is higher for blast-furnace employees than for employees in hand rolling mills. In the latter the maximum annual earnings of more than half, 53.8 per cent, were less than $600, as against 45 per cent in the blast-furnace department. Those with maximum annual earnings of less than $400 formed 15.4 per cent in the hand rolling mills, as compared with 9.1 per cent in the blast-furnace department. Above $600 the level of annual earnings was higher for the hand rolling mill employees, since the hourly rates of the skilled employees in these mills were so much higher than in the blast furnaces as to counterbalance the irregular employment in the rolling mills. Below $600 the possibilities for annual earnings were least in the hand rolling mills, next in the blast furnaces, followed in order by the mechanical rolling mills and the Bessemer converting department. Above $600 the possibilities for annual earnings were least in the blast-furnace department, followed by the Bessemer, mechanical rolling mills, and hand rolling mills in order.

The possibilities for annual earnings were greatest in the open-hearth department. It should be noted, however, that the operating time for the open-hearth department was reported on a slightly different basis from that of the other departments. For the other departments a statement of the operating time of each producing unit was secured. In the open-hearth department each separate furnace constitutes a producing unit, but as it was impossible to secure the operating time for each furnace separately, only the number of days the department as a whole was in operation was used. Some of the furnaces were undoubtedly shut down or under repair during some part of the year. It is not believed that this affects the accuracy of the figures to any considerable extent, since the skilled workmen on such furnaces are largely employed in repair work during such periods, while the unskilled workmen are usually assigned to other duties.

OPPORTUNITIES FOR ANNUAL EARNINGS IN THE SEVERAL DISTRICTS.

In the discussion of hourly earnings,[1] it was pointed out that a comparison of the different districts could not properly be made for the industry as a whole, because the various departments differ widely in the proportion of unskilled laborers employed and the departments are very unequally distributed in the different districts. The Southern district, for example, should not be compared with others, because it has an unusually high proportion of blast furnaces, in which two-thirds of the workmen are unskilled. The same consideration is of weight in a study of the opportunities for annual earnings, and consequently comparisons of districts are made only in the separate departments.

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[1] Vol. I, p. xxxiv.

BLAST FURNACES.

Annual earnings in the blast-furnace department are of special interest because of the presence of large proportions of unskilled workmen earning low hourly rates, but having relatively steady work throughout the year.

The opportunities for annual earnings in this department are shown in the following table for each district by means of percentages of employees whose maximum earnings fell below the specified amounts. The percentages are, of course, cumulative:

OPPORTUNITIES FOR ANNUAL EARNINGS OF EMPLOYEES IN BLAST FURNACES. OPERATED AT LEAST 6 MONTHS DURING THE YEAR, BY DISTRICTS, 1910.

Annual earnings.	Per cent of employees whose maximum annual earnings fell below specified amounts.					
	New England district (369 employees).	Eastern district (4,693 employees).	Pittsburgh district (10,664 employees).	Great Lakes and Middle West district (8,042 employees).	Southern district (4,899 employees).	Total (28,667 employees).
Under $400	0.3	9.6	2.9	2.9	33.1	9.1
Under $500	11.1	29.1	12.4	14.9	62.1	24.3
Under $600	29.5	68.1	29.4	33.0	77.7	45.0
Under $700	62.3	86.2	56.2	60.0	89.3	67.9
Under $800	81.3	94.7	78.8	81.4	95.0	84.9
Under $900	90.2	98.1	89.5	89.3	97.1	92.2
Under $1,000	92.7	99.1	94.3	93.5	98.4	95.6
Under $1,100	97.3	99.5	97.2	96.7	99.0	97.8
Under $1,200	98.9	99.6	98.6	98.4	99.4	98.8

The most important districts for this department are the Pittsburgh district and the Great Lakes and Middle West district, which together employ 65 per cent of the 28,667 employees for whom data as to annual earnings are shown. The opportunities for annual earnings in the blast furnaces were greatest in these two districts.

The lowest level of earnings was in the Southern district. Less than 3 per cent of the blast-furnace employees in this district had an opportunity to earn as much as $900 or $75 a month the year through, and the maximum earnings of more than 75 per cent fell below $600 (i. e., averaged less than $50 per month). The maximum earnings of one-third (33.1 per cent) were less than $400 per year ($33 per month).

In the Eastern district, the situation was approximately the same—less than 2 per cent having an opportunity to earn as much as $900, while the maximum annual earnings of 68.1 per cent of the employees in this district were less than $600.

The New England district had only 369 employees, hence no satisfactory comparison can be made.

BESSEMER CONVERTERS.

Details as to annual earnings in this department are shown for the Pittsburgh district and the Great Lakes and Middle West district. Data for the computation of annual earnings were reported for only one establishment in the Eastern district and one in the Southern district. These two districts are therefore omitted from the tables for this department in order to avoid disclosing the operations of these two companies.

The percentage of employees whose maximum earnings fell below the specified amounts are shown in the following table:

OPPORTUNITIES FOR ANNUAL EARNINGS OF EMPLOYEES IN BESSEMER CONVERTERS OPERATED AT LEAST 6 MONTHS DURING THE YEAR, BY DISTRICTS, 1910.

Annual earnings.	Per cent of employees whose maximum annual earnings fell below specified amounts.		
	Pittsburgh district (2,988 employees).	Great Lakes and Middle West district (1,633 employees).	Total (5,327 employees).
Under $400	2.8	9.9	6.8
Under $500	13.6	18.3	19.8
Under $600	33.4	40.0	40.0
Under $700	53.9	63.4	60.9
Under $800	72.3	78.4	76.6
Under $900	80.3	85.0	83.3
Under $1,000	86.5	88.0	88.2
Under $1,100	89.5	90.4	90.9
Under $1,200	92.8	91.8	93.2

In each of the districts shown in the table the maximum earnings of more than half the employees fell below $700, which is equivalent to about $58 per month for the year, and less than 10 per cent had an opportunity to earn as much as $1,200.

OPEN-HEARTH FURNACES.

The opportunities for annual earnings in the open-hearth department are shown in the following table, which gives for each of the five districts the proportion of employees whose maximum earnings fell below the specified amount.

OPPORTUNITIES FOR ANNUAL EARNINGS OF EMPLOYEES IN OPEN-HEARTH FURNACES OPERATED AT LEAST 6 MONTHS DURING THE YEAR, BY DISTRICTS, 1910.

Annual earnings.	Per cent of employees whose maximum annual earnings fall below specified amounts.					
	New England district (243 employees).	Eastern district (3,177 employees).	Pittsburgh district (6,065 employees).	Great Lakes and Middle West district (3,430 employees).	Southern district (466 employees).	Total (13,381 employees).
Under $400	8.2	18.3	4.5	2.3	2.8	5.6
Under $500	38.2	28.7	9.4	4.9	18.3	13.9
Under $600	62.6	42.3	27.3	16.0	38.0	28.9
Under $700	[illegible]	65.5	48.1	46.2	55.2	52.6
Under $800	86.8	78.5	64.2	62.7	[illegible]	67.1
Under $900	88.7	85.5	71.5	70.3	[illegible]	75.1
Under $1,000	92.2	91.5	[illegible]	[illegible]	80.9	82.0
Under $1,100	95.1	93.9	84.6	83.6	[illegible]	86.7
Under $1,200	95.9	95.0	88.6	85.6	88.5	88.8

It has already been noted that the maximum annual earnings in this department were higher than in any other of the five principal departments. Within the open-hearth departments, however, there are considerable variations among the different districts. The highest level was in the Great Lakes and Middle West district. Conditions in the Pittsburgh district are of great importance, since it includes 6,065, or nearly one-half of the 13,381 employees in this department. In the Pittsburgh district the maximum earnings of nearly one-half of the employees were less than $700, or less than an average of $58 per month.

Annual earnings in the Eastern district were decidedly lower than in either the Pittsburgh district or the Great Lakes and Middle West district. No comment will be made in regard to the New England and the Southern districts, as there were in these districts only 243 and 466 employees, respectively.

ROLLING MILLS.

The rolling mills form the most interesting element in the study of annual earnings. Annual earning opportunity in these mills is of the utmost significance, because there is a general impression that the workmen in the rolling mills receive very large incomes.

It is true that relatively high hourly rates are earned by some of the skilled workmen, but there is a very considerable proportion of semiskilled labor employed for whom the hourly rates are not high. About 40 per cent of the employees in rolling mills earned less than 18 cents per hour in 1910. Moreover, the effect of high hourly rates, where they do exist, is offset by the factor of intermittent employment. This is especially true in the hand rolling mills, where, in spite of the high rates paid the rollers and heaters, only one-sixth (16.5 per cent) of the employees had an opportunity to earn as much as $1,000 during the year.

MECHANICAL ROLLING MILLS.

Earnings in the mechanical rolling mills are of importance, since, as has been pointed out, they are supplanting the hand mills, and require a larger portion of semiskilled and a smaller portion of highly skilled workmen.

The following table shows for each district the proportion of employees whose maximum earnings fell below each specified amount:

OPPORTUNITIES FOR ANNUAL EARNINGS OF EMPLOYEES IN MECHANICAL ROLLING MILLS OPERATED AT LEAST 6 MONTHS DURING THE YEAR, BY DISTRICTS, 1910.

Annual earnings.	Per cent of employees whose maximum annual earnings fell below specified amounts.					
	New England district (178 employees).	Eastern district (3,949 employees).	Pittsburgh district (9,230 employees).	Great Lakes and Middle West district (7,468 employees).	Southern district (755 employees).	Total (21,580 employees).
Under $400	....	15.8	6.2	6.1	11.4	8.1
Under $500	12.9	39.8	16.5	17.4	24.0	21.3
Under $600	32.0	57.2	39.3	44.1	57.9	44.8
Under $700	51.1	69.5	56.1	66.1	69.9	62.5
Under $800	71.3	77.9	66.7	78.9	79.6	73.4
Under $900	79.8	85.4	74.9	83.7	84.0	80.2
Under $1,000	89.3	89.0	81.6	87.8	88.4	85.4
Under $1,100	93.8	91.0	86.6	90.9	91.5	89.1
Under $1,200	97.8	94.2	89.4	92.5	93.9	91.6

The bulk of the employees was in three districts, the Eastern, the Pittsburgh, and the Great Lakes and Middle West.

Maximum annual earnings were highest in the Pittsburgh district, but in the Great Lakes and Middle West district were only slightly lower. The lowest level was in the Eastern district, where the maximum earnings of 39.8 per cent fell below $500, which is equivalent to about $40 per month the year through.

Earnings in the Southern district appear to be very slightly higher than in the Eastern district, but the number of employees in the Southern district is too small to allow of a satisfactory comparison. For the same reason no comment is made in regard to earnings in the New England district.

HAND ROLLING MILLS.

Notwithstanding the presence of some skilled men earning high hourly rates, it will be noted from the following table that in every district the maximum annual earnings of more than one-half of the employees in the hand rolling mills fell below $600, which is equivalent to an average of $50 per month. In the Southern district the maximum annual earnings of 78.9 per cent fell below this amount.

OPPORTUNITIES FOR ANNUAL EARNINGS OF EMPLOYEES IN HAND ROLLING MILLS OPERATED AT LEAST 6 MONTHS DURING THE YEAR, BY DISTRICTS, 1910.

Annual earnings.	Per cent of employees whose maximum annual earnings fell below specified amounts.					
	New England district (933 employees).	Eastern district (2,803 employees).	Pittsburgh district (8,825 employees).	Great Lakes and Middle West district (4,321 employees).	Southern district (753 employees).	Total (17,635 employees).
Under $400	24.4	20.8	11.9	10.3	54.6	15.4
Under $500	41.9	45.6	31.4	27.7	71.6	35.0
Under $600	57.6	58.8	50.7	51.7	78.9	53.8
Under $700	64.2	69.8	64.4	65.0	84.3	66.2
Under $800	75.8	78.0	71.3	71.8	85.7	73.4
Under $900	83.2	82.1	76.6	77.9	92.4	78.8
Under $1,000	87.0	86.9	81.5	83.0	94.2	83.5
Under $1,100	88.1	88.9	85.3	85.8	94.8	86.5
Under $1,200	88.5	90.8	88.3	88.2	95.6	89.0

In this table is shown how small was the proportion of the highly skilled workmen who had the opportunity to work with comparative steadiness. There were 23.5 per cent of the employees in the hand mills whose full-time weekly earnings were $19.25 or more, which is the equivalent of $1,000 or more per full year. The actual operating conditions, however, were such that only 16.5 per cent could have earned as much as $1,000. Thus, the mills gave an opportunity for only three-fourths as many workmen to earn $1,000 or more as if they had operated full time throughout the year.

CHAPTER IX.

TREND OF WAGES, 1900 TO 1910.

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INTRODUCTION.

A study of the trend of wages in the iron and steel industry during the past decade is significant not only because a knowledge of past conditions best illustrates the present situation but also because the iron and steel industry has been completely reorganized since 1900. This reorganization applies particularly to the consolidation of ownership and control, but it has also directly affected the location and equipment of plants. The purpose of this study is not only to discover to what extent wages have increased or decreased, but more particularly to learn to what extent the different classes of employees have been affected by the increase or decrease.

Comparable data, covering the hourly earnings in 1900,[1] 1905, and 1910, of employees in the various producing departments, were furnished for 28 plants. In each of the three years, identically the same plants are included, the only changes being either modifications of equipment or the construction of additional producing units. A total of between 11,000 and 12,000 employees are included in the departments considered in each of the years specified. It must not be understood that each of the 28 plants had all of the departments which are considered below. The distribution was as follows: Blast furnaces were reported by 10 plants, open-hearth furnaces by 7, Bessemer converters by 8, blooming mills by 10, rod mills by 7, and bar mills (including merchant and hoop mills) by 5 plants.

In this study all foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted from consideration, the purpose being to show the trend of wages among the actual operating force. Also, attention is limited to the producing departments, in which are employed the workmen dependent for their livelihood on the iron and steel industry. This limitation avoids the effect which conditions in competitive industries might have upon the wages of the mechanical force.

None of the companies included in this study dealt with any organization of labor in any of the departments in 1905 or 1910. In 1900 one of the companies recognized the Amalgamated Association of Iron, Steel, and Tin Workers in its bar, guide, and hoop mills.

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[1] For certain of these establishments the earnings reported for the first period are taken from the pay rolls of 1902, which were the earliest available, but in each case the time and tonnage rates reported as of that year were the same as those paid in 1900. No plants are included in which there were any significant improvements or modifications in equipment or processes between 1900 and 1902.

The following analysis of the obtained data regarding the wage movement from 1900 to 1910 is made, for convenience of presentation, under three heads.

(1) Consideration is given to the trend of hourly wage rates among all classes of employees, skilled, semiskilled, and unskilled.

(2) A special study is made of the course of hourly wage rates among common or unskilled labor alone, this class of labor being of such prominence in the industry as to warrant separate study.

(3) The extent of changes in tonnage rates and their effect on the earnings of tonnage workers are discussed in some detail.

HOURLY WAGE RATES, 1900 TO 1910, ALL CLASSES OF LABOR.

With the exception of the highly skilled workmen the wages of all classes of employees in the producing departments of the iron and steel industry increased during the period 1900 to 1910. The average hourly rates of the employees in the producing departments of the plants included in this study were, approximately, 21 cents per hour in 1900 and 23.7 cents per hour in 1910. Wages in 1910 were, therefore, 12.9 per cent higher than in 1900. This increase took place almost altogether after 1905, the average hourly rates in 1905 being 20.2 cents per hour or 3.8 per cent less than in 1900. It is true that between 1900 and 1905 the wages of the unskilled laborers and other relatively low paid workmen were slightly increased, but at the same time the wages of the skilled workmen were so considerably reduced as to effect an actual reduction in the average hourly rates of the whole force.

From 1900 to 1910 the retail prices of food are shown by the Bureau of Labor to have increased almost 40 per cent. The increase was steady throughout the period, as shown in the following table:

RELATIVE PRICES (WEIGHTED) OF FOOD, 1900 TO 1910.

[Computed from data published in Bulletin of the Bureau of Labor, No. 105, Pt. 1, p. 17. Relative prices in 1900=100.]

Years.	Relative prices.	Years.	Relative prices.
1900	100.0	1906	116.8
1901	105.3	1907	122.2
1902	111.3	1908	126.3
1903	111.4	1909	133.2
1904	112.8	1910	139.9
1905	113.0		

During the same period the labor cost of production in the departments under consideration either increased very slightly or actually decreased. This is shown by the following figures compiled from the Report of the Commissioner of Corporations on the Steel Industry.

COMPARISON OF LABOR COST PER GROSS TON OF SPECIFIED PRODUCTS IN 1902-1906 AND IN 1910.

[Compiled from Report of the Commissioner of Corporations on the Steel Industry, Part II. Preliminary Report, pp. 82, 85, 87, 88.]

Products.	Labor cost per ton.		Relative cost in 1910 (cost in 1902-1906 taken as 100).
	1902-1906.	1910.	
Bessemer pig iron [1]	$0.67	$0.48	72
Bessemer billet ingots [2]	.62	.54	87
Bessemer rail ingots [3]	.49	.52	106
Heavy Bessemer rails [3]	1.01	1.14	113

[1] Three plants of the Steel Corporation, both periods.
[2] One plant of the Steel Corporation, both periods.
[3] Two plants of the Steel Corporation, both periods.

It should be noted that in this case 1910 is compared with the average from 1902 to 1906. Between 1902 and 1906 many improvements in machinery tending to reduce the labor cost were made, while wages were not increased. It seems probable, therefore, that labor costs in 1902 were considerably higher than the average for 1902 to 1906 and consequently that the labor costs on all products decreased between 1902 and 1910 in spite of the increase of 12.9 per cent in the average wages.

Although there was an increase of 12.9 per cent in the average wages of all employees from 1900 to 1910, this increase did not apply uniformly to all classes of employees. The general trend of wages in the iron and steel industry from 1900 to 1910 may be briefly described as a tendency to the leveling of the wages of all employees. This has been accomplished by considerable increases in the wages of the unskilled and relatively low-paid workmen, by smaller increases for the semiskilled employees, and by very slight increases or actual decreases in the wages of the highly skilled workmen.

This readjustment is clearly shown in the following table, which is a summary of the more detailed tables presented later:

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, ALL DEPARTMENTS, 1900, 1905, AND 1910.

[Figures are for 28 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 16 cents	6,085	51.9	6,011	50.2	530	4.7
16 and under 25 cents	3,581	30.5	4,148	34.7	7,845	69.9
25 and under 60 cents	1,754	14.9	1,603	13.4	2,607	23.2
60 cents and over	317	2.7	199	1.7	246	2.2
Total	11,737	100.0	11,961	100.0	11,228	100.0

The wages of the unskilled laborers increased from 1900 to 1910 to such an extent that whereas in 1900 there were 51.9 per cent of the total force earning less than 16 cents per hour, in 1910 only 4.7 per cent earned less than 16 cents per hour and these were chiefly boys. This increase took place almost entirely after 1905 and in most of the plants occurred in May, 1910. Between 1900 and 1905, however, the wages of many of the highly skilled workmen were so reduced that in 1905 only 199, or 1.7 per cent of the entire force, earned as much as 60 cents per hour in contrast with 317, or 2.7 per cent of the total force, who were reported as earning 60 cents per hour and over in 1900.

The "readjustment" of wages through unusually large increases in wages for the lower paid employees as compared with the highly paid, which has been described as occurring between 1900 and 1910 in the steel industry, was not characteristic of manufacturing industries in general. The following table compiled from the reports of the Bureau of Statistics of New Jersey, the only available figures which are at all comparable, shows that between 1900 and 1910 the wages of all classes of employees in the industries of that State increased very nearly uniformly.

CLASSIFIED WEEKLY EARNINGS OF ALL EMPLOYEES IN ALL INDUSTRIES, NEW JERSEY, 1900 AND 1910.

[Compiled from Reports of Bureau of Statistics of New Jersey, 1901, p. 101, and 1911, p. 122.]

Classified weekly earnings.	Per cent of employees earning each classified amount.		Weekly earnings.	Per cent of employees earning each specified amount and over.	
	1900 (195,798 employees.)	1910 (329,826 employees.)		1900	1910
Under $5	17.8	7.9			
$5 and under $6	7.9	6.8	$5 and over	82.2	92.1
$6 and under $7	7.7	7.5	$6 and over	74.3	85.3
$7 and under $8	9.8	7.4	$7 and over	66.6	77.8
$8 and under $9	8.4	8.7	$8 and over	56.8	70.4
$9 and under $10	11.1	11.2	$9 and over	48.4	61.7
$10 and under $12	10.9	14.8	$10 and over	37.3	50.5
$12 and under $15	11.6	14.1	$12 and over	26.4	35.7
$15 and under $20	10.3	14.1	$15 and over	14.8	21.6
$20 and over	4.5	7.5	$20 and over	4.5	7.5

The reductions in wages in the iron and steel industry between 1900 and 1910 affected only the workmen earning 60 cents or more per hour, most of whom are in supervisory positions and perform little manual labor. The president of the Amalgamated Association of Iron, Steel, and Tin Workers in his report for 1910 referred to the need for some such readjustment as follows:

> Unpopular as it once was, the suggestion is fast gaining ground that some readjustment of our wage scale should be made that would tend to establish a closer mutual interest between all those governed by it, so that each will have a wage that will not be the envy of his

fellows and that will not permit of the sacrifice of part of it, or of principles or conditions just as important, in an effort to maintain a position by managerial favor. To my mind action in accordance with this suggestion would be a boon to the many loyal independent spirited union men that now hold such jobs, but can feel no security in them while such conditions exist and they retain their independence.[1]

In order that the significance of the changes in wages in the steel industry may be better understood, some information as to the characteristics of the different classes of workmen is briefly presented here. This information is based on a study of the records of all employees of a large plant in the Pittsburgh district, which is representative of the plants for which wage data are presented. The detailed table is shown in Appendix C, but may be summarized as follows:

First, the skilled workmen, whose wages were only slightly increased or actually reduced between 1900 and 1910, are largely men with families, 80 per cent of all the workmen earning 25 cents and over per hour being married. Of the skilled workmen 60 per cent are American born; 25 per cent are natives of the northern and western European countries, of whom more than 80 per cent have been in the United States 10 years or more and have adopted American habits. It is proper, therefore, to consider that at least four-fifths of the skilled workmen are accustomed to American standards, which can be altered to conform with a reduction of wages or with the increased price of commodities only by sacrifices of some kind. Furthermore, 70 per cent of the skilled workmen have been connected with the iron and steel industry for 10 years or more and in a certain measure have become so identified with the industry that they can not be expected to leave it willingly to seek work in new fields.

Second, the unskilled workmen whose wages have been most largely increased are chiefly recent immigrants, 73 per cent of them having been born in southern or eastern Europe. Thus only 27 per cent are American born or immigrants from western and northern Europe. About one-third of the unskilled are married, with families in this country.[2] Approximately 50 per cent have been employed in the industry less than 5 years.

The semiskilled have less definite characteristics. The American born constitute 30 per cent and the natives of northern and western Europe approximately 13 per cent, leaving 57 per cent who are natives of eastern and southern Europe. About two-thirds of the semiskilled are married, and approximately 70 per cent have been employed in the industry at least 5 years, but only 35 per cent as long as 10 years.

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[1] Journal, Amalgamated Association of Iron, Steel, and Tin Workers, 1910, p. 8960.

[2] This estimate is based on the report of the Immigration Commission, in which it is shown that practically all of the immigrants from northern and western Europe have brought their wives and families to this country, and that about 40 per cent of the married southern and eastern European immigrants have left their wives and families abroad. See p. 163.

The following table shows for the years 1900, 1905, and 1910 the per cent of employees earning each classified amount per hour. In addition a summary showing the per cent earning under 18 cents, 18 and under 25 cents, and 25 cents and over per hour is given.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, ALL DEPARTMENTS, 1900, 1905, AND 1910.

[Figures are for 28 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 14 cents	649	5.5	311	2.6	226	2.0
14 and under 16 cents	5,436	46.3	5,700	47.7	304	2.7
16 and under 18 cents	1,543	13.1	1,683	14.1	4,163	37.1
18 and under 20 cents	749	6.4	1,105	9.2	1,587	14.1
20 and under 25 cents	1,289	11.0	1,360	11.4	2,095	18.7
25 and under 30 cents	740	6.3	585	4.9	1,010	9.0
30 and under 40 cents	599	5.1	606	5.1	1,039	9.3
40 and under 50 cents	278	2.4	270	2.3	328	2.9
50 and under 60 cents	137	1.2	142	1.2	230	2.0
60 and under 70 cents	91	.8	104	.9	119	1.1
70 and under 80 cents	84	.7	44	.4	54	.5
80 and under 90 cents	69	.6	31	.3	36	.3
90 cents and under $1	25	.2	8	.1	17	.2
$1 and over	48	.4	12	.1	20	.2
Total	11,737	100.0	11,961	100.0	11,228	100.0
Under 18 cents	7.628	65.0	7,694	64.3	4,693	41.8
18 and under 25 cents	2.038	17.4	2,465	20.6	3,682	32.8
25 cents and over	2,071	17.6	1,802	15.1	2,853	25.4
Total	11,737	100.0	11,961	100.0	11,228	100.0

In order to make an easy comparison of the earnings of employees in 1900 and in 1910 the diagram shown on page 238 has been prepared.

The first part of the diagram shows graphically for each of the years the per cent of employees earning each classified amount and is based upon the data of the preceding table.

The second part of the diagram, which is virtually a summary of the first, shows the per cent earning, respectively, less than 18 cents, 18 and under 25 cents, and 25 cents and over per hour.

The third part of the diagram, which gives an idea of the cumulative effect of the various changes, is based upon the following table. This table shows by means of cumulative numbers and percentages the number and per cent of employees who earn each specified amount and over. For example, in 1900, 73 employees, or 0.6 per cent of the total number, earned 90 cents and over per hour. These 73, of course, include the 48 reported in the same year as earning $1 and over.

CUMULATIVE NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT AND OVER PER HOUR, ALL DEPARTMENTS, 1900 AND 1910.

[Figures are for 28 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1910	
	Number.	Per cent.	Number.	Per cent.
14 cents and over	11,068	94.5	11,002	98.0
16 cents and over	5,652	48.2	10,698	95.3
18 cents and over	4,109	35.0	6,535	58.2
20 cents and over	3,360	28.6	4,948	44.1
25 cents and over	2,071	17.6	2,853	25.4
30 cents and over	1,331	11.3	1,843	16.4
40 cents and over	732	6.2	804	7.2
50 cents and over	454	3.9	476	4.2
60 cents and over	317	2.7	246	2.2
70 cents and over	226	1.9	127	1.1
80 cents and over	142	1.2	73	.7
90 cents and over	73	.6	37	.3
$1 and over	48	.4	20	.2

The third part of the diagram shows more clearly than either of the other two parts the changes in wages between 1900 and 1910; namely, considerable increases in the wages of the low-paid and relatively unskilled employees and actual decreases in the wages of the highly skilled employees earning 60 cents and over per hour.[1]

BLAST FURNACES.

Although in 1910 there were 43 furnaces in the 10 establishments reported, as against 34 in 1900, there was a considerable reduction in the number of employees between those years. This decrease was due largely to the fact that at three plants the furnaces were changed during the period from the vertical-hoist type, using a large force of bottom fillers, to the skip-hoist type, using larry cars, while at another plant there was a large reduction in the force of yard employees in consequence of a change in the method of handling stock.[2] These changes had the effect of reducing by several hundred the number of employees in these four plants.

In 1900 there were 77 per cent of the employees in these blast furnaces earning under 16 cents per hour, only 7.1 per cent earned 20 cents and over per hour, and none earned as much as 40 cents per hour.

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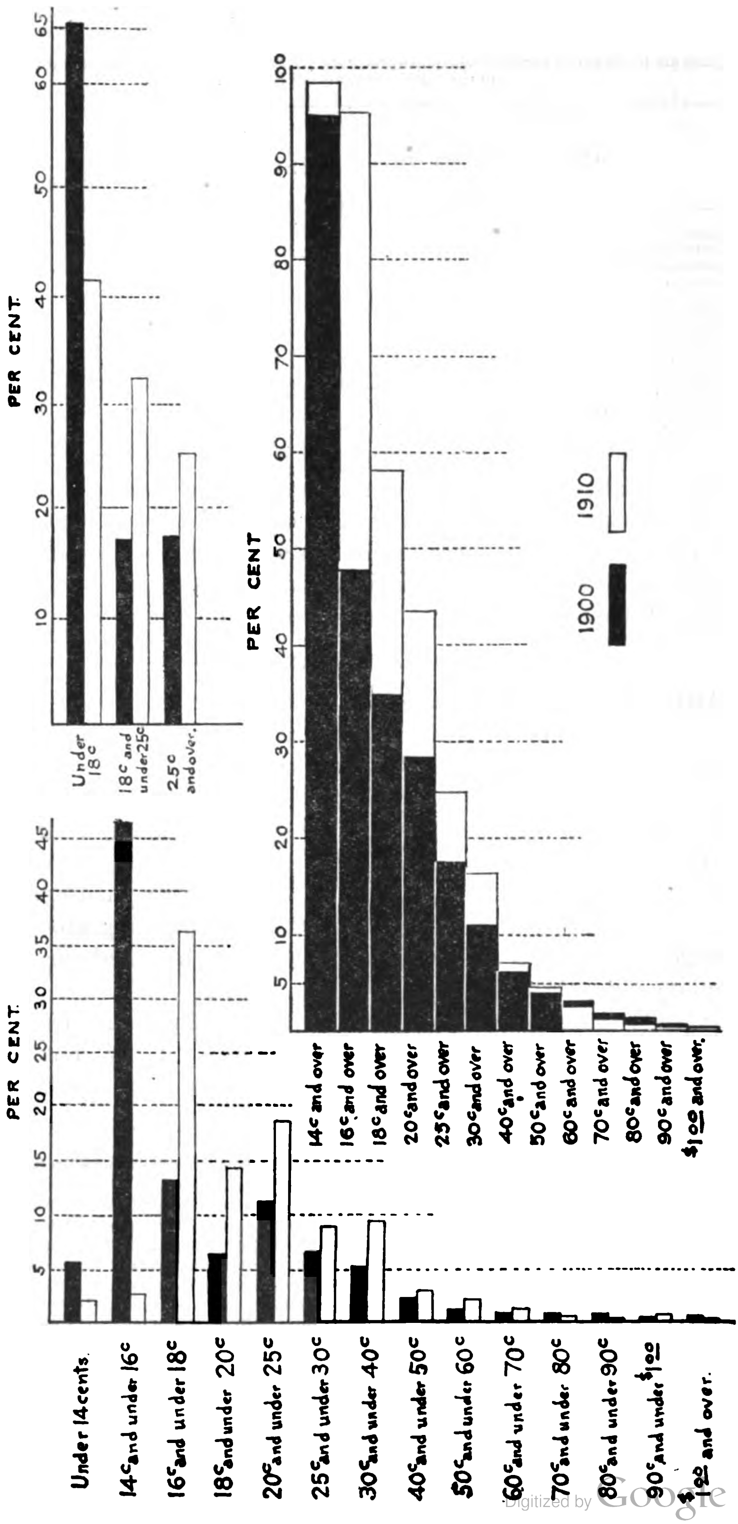
[1] As this part of the diagram may not be understood at first glance a brief explanation is given. In 1900 the proportion of the total force earning 14 cents and over per hour (94.5 per cent) is represented by the solid black area of the column, while the proportion earning 14 cents and over per hour (98.0 per cent) in 1910 is represented by the solid black area plus the small white area. The small white area, therefore, represents the increase in the proportion earning 14 cents per hour and over in 1910 as compared with 1900. The proportion of employees earning 60 cents and over per hour in 1910 was smaller than in 1900. Therefore the white area opposite 60 cents and over per hour represents the proportion of employees earning that amount in 1910, while the proportion of employees earning the same amount in 1900 is represented by the white area plus the small black area. The decrease in the proportion earning 60 cents and over per hour in 1910 as compared with 1900 is therefore represented by the black area. In other words the diagram shows graphically the increases and decreases in the proportion earning each specified amount between 1900 and 1910. The white area at the end of the solid black represents the amount of increase of 1910 over 1900, while the black area at the end of the white represents the amount of the decrease between 1900 and 1910.

[2] For the extent of reductions in the size of the force due to such changes, see Chapter XIII, especially p. 341.

PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR IN ALL DEPARTMENTS, 1900 AND 1910.

ALL DEPARTMENTS



In 1905 there were 64.3 per cent working for less than 16 cents per hour, 9.3 per cent earned 20 cents or more per hour, while only 0.1 per cent earned as much as 40 cents per hour.

In 1910, through the advance in common labor rates, only 5.4 per cent of the employees earned less than 16 cents per hour. The wages of the semiskilled were also increased, so that 31.4 per cent earned 20 cents and over per hour. There was likewise an increase in the percentage earning each of the higher classified amounts per hour. None, however, earned as much as 50 cents per hour.

The following table shows for 1900, 1905, and 1910 the number and per cent of employees earning each classified amount per hour in blast furnaces:

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, BLAST FURNACES, 1900, 1905, AND 1910.

[Figures are for 10 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 14 cents	164	3.6	81	1.6	65	1.5
14 and under 16 cents	3,314	73.4	3,136	62.7	165	3.9
16 and under 18 cents	492	10.9	910	18.2	1,877	44.1
18 and under 20 cents	227	5.0	409	8.2	816	19.2
20 and under 25 cents	257	5.7	332	6.6	887	20.9
25 and under 30 cents	56	1.2	83	1.7	254	6.0
30 and 40 cents	8	.2	43	.9	182	4.3
40 and under 50 cents	....	....	4	.1	7	.2
50 cents and over	....	....	....	....	....	....
Total	4,518	100.0	4,998	100.0	4,253	100.0
Under 18 cents	3,970	87.9	4,127	82.6	2,107	49.5
18 and under 25 cents	484	10.7	741	14.8	1,703	40.1
25 cents and over	64	1.4	130	2.6	443	10.4
Total	4,518	100.0	4,998	100.0	4,253	100.0

The following table presents in cumulative form the data shown in the preceding table for 1900 and 1910:

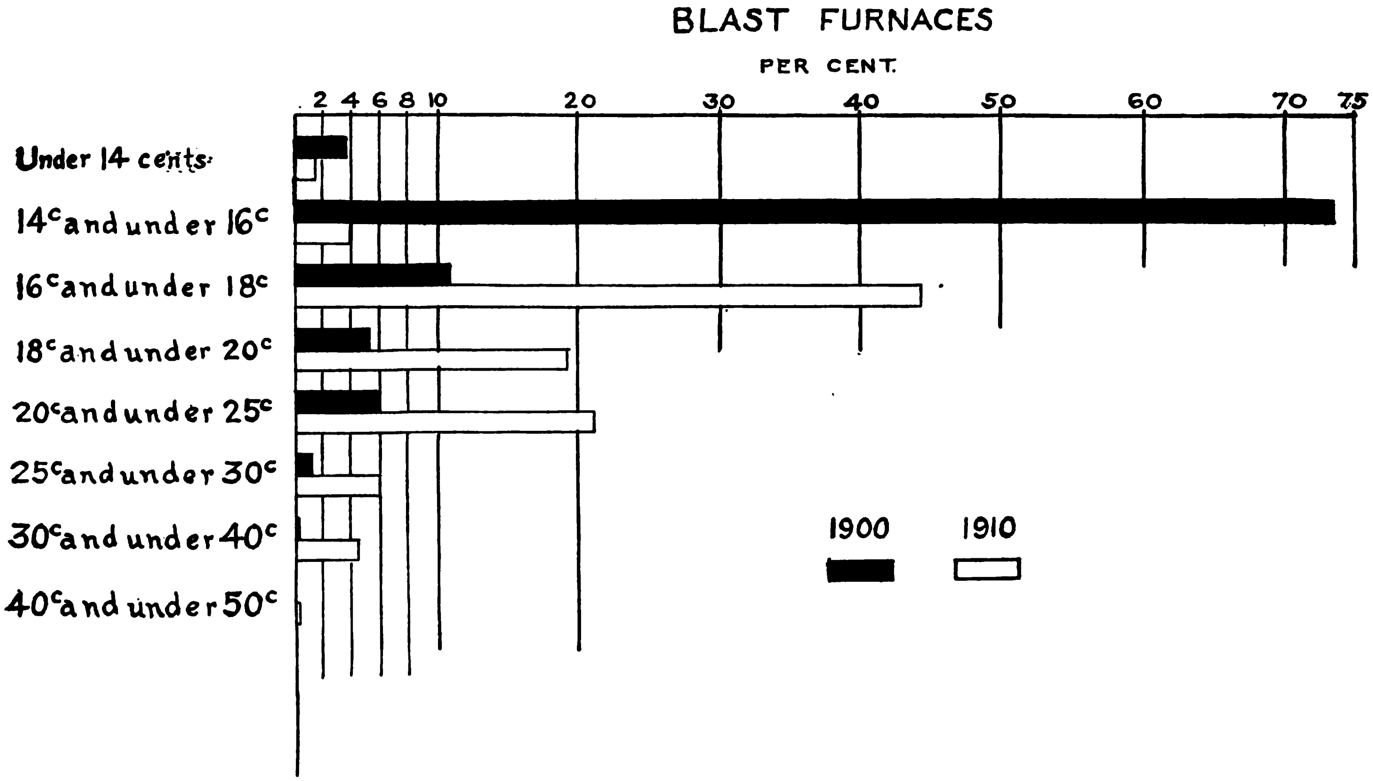
CUMULATIVE NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT AND OVER PER HOUR, BLAST FURNACES, 1900 AND 1910.

[Figures are for 10 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Hourly earnings.	1900		1910	
	Number.	Per cent.	Number.	Per cent.
Under 14 cents	164	3.6	65	1.5
14 cents and over	4,354	96.4	4,188	98.5
16 cents and over	1,040	23.0	4,023	94.6
18 cents and over	548	12.1	2,146	50.5
20 cents and over	321	7.1	1,330	31.3
25 cents and over	64	1.4	443	10.4
30 cents and over	8	.2	189	4.4
40 cents and over	....	....	7	.2

The following diagram presents in graphic form for 1900 and 1910 the per cent of employees earning each classified amount in blast furnaces.

PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR IN BLAST FURNACES, 1900 AND 1910.



BESSEMER CONVERTERS.

The number of employees in the Bessemer converters for which data are presented decreased 7 per cent between 1900 and 1905. This decrease was in some measure due to the substitution of "direct metal" for cupola metal, and resulted in the displacement of a number of comparatively highly paid men employed in connection with the cupolas.

In the Bessemer converters the readjustment of wages described in the first part of the chapter is clearly illustrated. Between 1905 and 1910 the wages of the unskilled were so increased that, whereas in 1905 there were 48.3 per cent of the employees earning less than 16 cents per hour, in 1910 only 1.1 per cent earned less than 16 cents. The proportion of employees earning 50 cents and over per hour declined between 1900 and 1910 from 8 per cent to 5.9 per cent.

The following table shows the number and per cent of employees in Bessemer converters earning each classified amount per hour in 1900, 1905, and 1910:

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, BESSEMER CONVERTERS, 1900, 1905, AND 1910.

[Figures are for 8 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 14 cents	135	6.6	6	0.3	17	0.9
14 and under 16 cents	838	41.0	912	48.0	3	.2
16 and under 18 cents	165	8.1	164	8.6	890	45.5
18 and under 20 cents	141	6.9	187	9.8	225	11.5
20 and under 25 cents	236	11.5	196	10.3	281	14.4
25 and under 30 cents	203	10.0	133	7.0	203	10.4
30 and under 40 cents	103	5.0	101	5.3	141	7.2
40 and under 50 cents	60	2.9	66	3.5	80	4.1
50 and under 60 cents	41	2.0	48	2.5	34	1.7
60 and under 70 cents	25	1.3	50	2.6	38	1.9
70 and under 80 cents	20	.9	12	.6	23	1.2
80 and under 90 cents	50	2.5	18	.9	15	.7
90 cents and under $1	9	.4	3	.2	3	.2
$1 and over	18	.9	3	.2	3	.2
Total	2,044	100.0	1,899	100.0	1,956	100.0
Under 18 cents	1,138	55.7	1,082	57.0	910	46.5
18 and under 25 cents	377	18.4	383	20.2	506	25.9
25 cents and over	529	25.9	434	22.8	540	27.6
Total	2,044	100.0	1,899	100.0	1,956	100.0

The diagram on page 244 gives in graphic form the data shown in the preceding table. The following table presents the data in cumulative form for 1900 and 1910.

CUMULATIVE NUMBER AND PER CENT OF EMPLOYEES EARNING EACH SPECIFIED AMOUNT AND OVER PER HOUR, BESSEMER CONVERTERS, 1900 AND 1910.

[Figures are for 8 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Hourly earnings.	1900		1910	
	Number.	Per cent.	Number.	Per cent.
14 cents and over	1,909	93.4	1,939	99.1
16 cents and over	1,071	52.4	1,936	99.0
18 cents and over	906	44.3	1,046	53.5
20 cents and over	765	37.4	821	42.0
25 cents and over	529	25.9	540	27.6
30 cents and over	326	15.9	337	17.2
40 cents and over	223	10.9	196	10.0
50 cents and over	163	8.0	116	5.9
60 cents and over	122	6.0	82	4.2
70 cents and over	97	4.7	44	2.2
80 cents and over	77	3.8	21	1.1
90 cents and over	27	1.3	6	.3
$1 and over	18	.9	3	.2

OPEN-HEARTH FURNACES.

In 1900 the number of employees who earned less than 16 cents per hour comprised 40 per cent of the total number engaged in productive occupations in the open-hearth departments of the 7 establishments reporting thereon, as against 37.2 per cent in 1905, and only 5.3 per cent in 1910.

There was in 1905 a notable decrease in the earnings of the more highly skilled employees, or those earning upward of 40 cents per hour, from their earnings in 1900, which reduction, however, had been partly restored as indicated by the earnings reported for 1910, except that none earned more than 90 cents per hour in the latter year, and fewer were earning more than 80 cents per hour than was the case in 1900.

At the time covered by the reports from which the tables were compiled there were in these establishments 94 open-hearth furnaces running in 1900, 98 in 1905, and 95 in 1910. For each of these years the number of employees was practically the same. The number of furnaces operated varied very slightly at the different periods, so that the average number of employees engaged in productive occupations in the open-hearth department was, per furnace, 22.7 in 1900, 21.6 in 1905, and 22.3 in 1910. The following table shows for 1900, 1905, and 1910 the number and per cent of employees earning each classified amount per hour in open-hearth furnaces.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, OPEN-HEARTH FURNACES, 1900, 1905, AND 1910.

[Figures are for 7 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 14 cents	148	6.9	45	2.1	71	3.4
14 and under 16 cents	706	33.1	744	35.1	40	1.9
16 and under 18 cents	178	8.4	227	10.7	600	28.3
18 and under 20 cents	166	7.8	234	11.0	222	10.5
20 and under 25 cents	452	21.2	542	25.6	501	23.7
25 and under 30 cents	234	11.0	130	6.1	303	14.3
30 and under 40 cents	158	7.4	164	7.7	295	13.9
40 and under 50 cents	65	3.1	4	.2	41	1.9
50 and under 60 cents	4	.2	8	.4	18	.9
60 and under 70 cents	4	.2	18	.8	12	.6
70 and under 80 cents	4	.2	4	.2	10	.5
80 and under 90 cents	8	.4	....	....	4	.2
90 cents and under $1	4	.2	....	....	....	....
Total	2,131	100.0	2,120	100.0	2,117	100.0
Under 18 cents	1,032	48.4	1,016	47.9	711	33.6
18 and under 25 cents	618	29.0	776	36.6	723	34.1
25 cents and over	481	22.6	328	15.5	683	32.3
Total	2,131	100.0	2,120	100.0	2,117	100.0

The following table shows in cumulative form the data presented in the preceding table for 1900 and 1910:

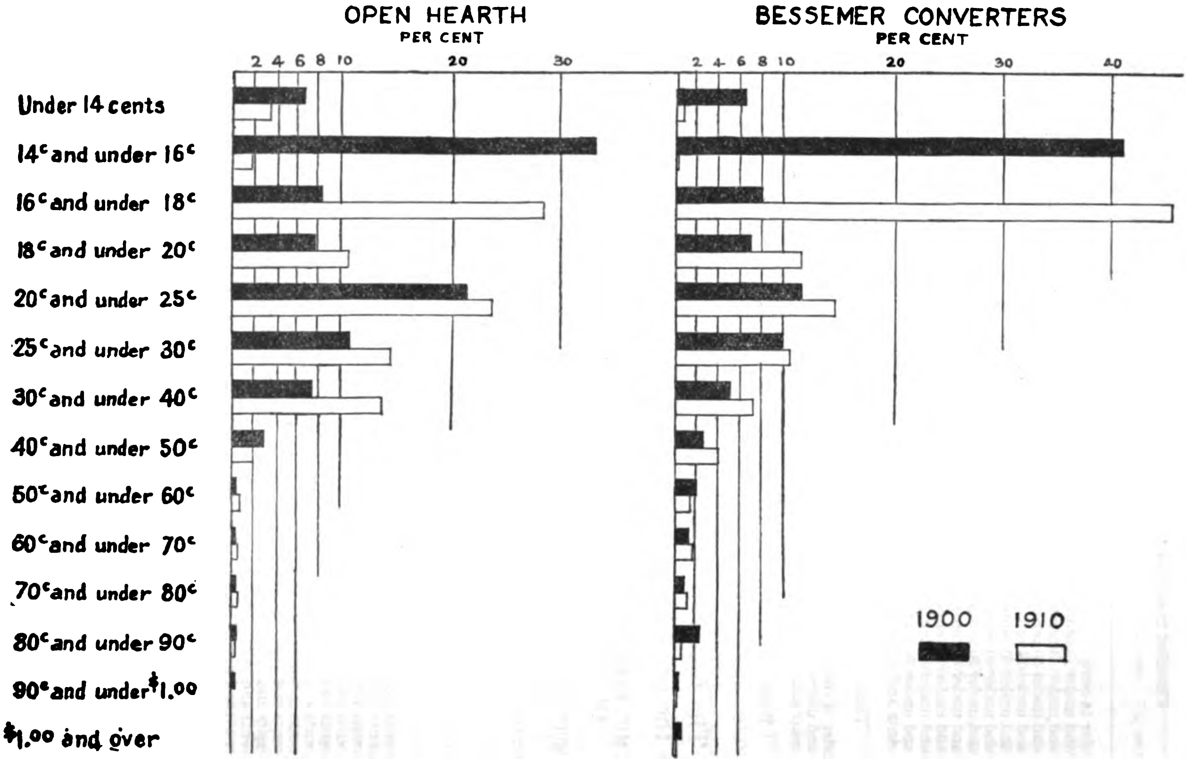
CUMULATIVE NUMBER AND PER CENT OF EMPLOYEES EARNING EACH SPECIFIED AMOUNT AND OVER PER HOUR, OPEN-HEARTH FURNACES, 1900 AND 1910.

[Figures are for 7 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Hourly earnings.	1900		1910	
	Number.	Per cent.	Number.	Per cent.
14 cents and over	1,983	93.1	2,046	96.6
16 cents and over	1,277	59.9	2,006	94.8
18 cents and over	1,099	51.6	1,406	66.4
20 cents and over	933	43.8	1,184	55.9
25 cents and over	481	22.6	683	32.3
30 cents and over	247	11.6	380	17.9
40 cents and over	89	4.2	85	4.0
50 cents and over	24	1.1	44	2.1
60 cents and over	20	.9	26	1.2
70 cents and over	16	.8	14	.7
80 cents and over	12	.6	4	.2
90 cents and over	4	.2	....	....

The following diagram presents in graphic form the per cent of employees earning each classified amount in open-hearth furnaces and in Bessemer converters.

PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR IN OPEN-HEARTH FURNACES AND BESSEMER CONVERTERS, 1900 AND 1910.



BLOOMING MILLS.

In the 10 blooming mills furnishing data there was a slight decrease in the aggregate number of employees reported as engaged in productive occupations in 1905 and 1910 from the number in 1900.

The number of employees earning under 16 cents per hour comprised 30.4 per cent of the total in 1900, 36 per cent in 1905, and only 1.7 per cent in 1910, in which latter year the number reported as earning 16 and under 18 cents comprised 41.7 per cent of the total as against 18.3 per cent in 1900 and 12.7 per cent in 1905. There was a marked increase in 1910 over the earlier years in the per cent within the class earning 20 and under 25 cents, while in the class earning 25 and under 30 cents there was a notable reduction. The general reduction, however, affected chiefly the employees earning 60 cents and over per hour.

In 1905 there were only 3 persons who earned over 80 cents per hour, as against 11 in 1900, a reduction in tonnage rates between those years having caused a material falling off in the earnings of heaters and rollers. In 1910 there were 14 earning over 80 cents per hour, of which number 6 earned $1 and over per hour.

The following table shows the number and per cent of employees earning each classified amount in blooming mills, for the years 1900, 1905, and 1910:

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, BLOOMING MILLS, 1900, 1905, AND 1910.

[Figures are for 10 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 14 cents	18	1.9	16	1.7	4	0.4
14 and under 16 cents	270	28.5	321	34.3	12	1.3
16 and under 18 cents	173	18.3	119	12.7	388	41.7
18 and under 20 cents	58	6.1	60	6.4	70	7.5
20 and under 25 cents	75	7.9	84	9.0	124	13.3
25 and under 30 cents	113	11.9	97	10.4	50	5.4
30 and under 40 cents	145	15.3	151	16.2	152	16.3
40 and under 50 cents	40	4.2	42	4.5	46	5.0
50 and under 60 cents	22	2.3	24	2.6	60	6.5
60 and under 70 cents	16	1.7	8	.9	4	.4
70 and under 80 cents	5	.5	9	1.0	6	.6
80 and under 90 cents	2	.2	....	....	3	.3
90 cents and under $1.00	6	.6	3	.3	5	.5
$1 and over	3	.3	....	....	6	.6
Total	946	100.0	934	100.0	930	100.0
Under 18 cents	461	48.7	456	48.8	404	43.4
18 and under 25 cents	133	14.1	144	15.4	194	20.9
25 cents and over	352	37.2	334	35.8	332	35.7
Total	946	100.0	934	100.0	930	100.0

The following table presents in cumulative form for 1900 and 1910 the data shown in the preceding table:

CUMULATIVE NUMBER AND PER CENT OF EMPLOYEES EARNING EACH SPECIFIED AMOUNT AND OVER PER HOUR, BLOOMING MILLS, 1900 AND 1910.

[Figures are for 10 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Hourly earnings.	1900		1910	
	Number.	Per cent.	Number.	Per cent.
Under 14 cents	18	1.9	4	0.4
14 cents and over	928	98.1	926	99.6
16 cents and over	658	69.6	914	98.3
18 cents and over	485	51.3	526	56.6
20 cents and over	427	45.1	456	49.0
25 cents and over	352	37.2	332	35.7
30 cents and over	239	25.3	282	30.3
40 cents and over	94	9.9	130	14.0
50 cents and over	54	5.7	84	9.0
60 cents and over	32	3.4	24	2.6
70 cents and over	16	1.7	20	2.2
80 cents and over	11	1.2	14	1.5
90 cents and over	9	1.0	11	1.2
$1 and over	3	.3	6	.6

BAR MILLS.

Five establishments furnished data covering the earnings of employees in departments which embraced 8, 9, 10, 12, and 16 inch bar mills, 8 and 10 inch hoop mills, 8-inch guide mills, and 10 and 12 inch merchant mills—in all, 11 mills, which have been included in the tables under the general head of bar mills.

In these mills the employees earning under 14 cents per hour formed a much higher percentage of the total force than in any of the other departments, there being 17.1 per cent in 1900, 11 per cent in 1905, and 6.9 per cent in 1910 in this classification. Practically all of the employees earning under 14 cents were boys. Between 1900 and 1910, in most of the plants, the boys were displaced by men. Unskilled laborers form only a small part of the labor force of the bar mills, as is shown by the fact that those earning under 16 cents amounted to only 27 per cent of the total number in 1900, 33.5 per cent in 1905 and 11.2 per cent in 1910. Employees earning under 18 cents comprised 37.9 per cent in 1900, 40.1 per cent in 1905, and 28.4 per cent in 1910, which are the lowest percentages shown in any of the departments.

The reduction in the proportion of workmen earning the larger amounts per hour was particularly severe in this department, affecting those earning 30 cents and over per hour. Large decreases in tonnage rates were made between 1900 and 1910. The output of the mills was increased, but the increased output was seldom sufficient to compensate for the tonnage rate reductions. Furthermore, the use of continuous roughing stands and continuous furnaces tended to reduce the number of highly paid men employed. The following table shows the number and per cent of employees earning each classified amount in bar mills, for 1900, 1905, and 1910:

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, BAR MILLS, 1900, 1905, AND 1910.

[Figures are for 5 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 14 cents	135	17.1	82	11.0	57	6.9
14 and under 16 cents	78	9.9	168	22.5	36	4.3
16 and under 18 cents	86	10.9	49	6.6	143	17.2
18 and under 20 cents	104	13.2	127	17.0	100	12.0
20 and under 25 cents	118	15.0	94	12.6	180	21.7
25 and under 30 cents	61	7.7	56	7.5	108	13.0
30 and under 40 cents	83	10.5	64	8.6	91	11.0
40 and under 50 cents	51	6.5	56	7.5	59	7.1
50 and under 60 cents	28	3.5	19	2.5	14	1.7
60 and under 70 cents	4	.5	6	.8	17	2.0
70 and under 80 cents	27	3.4	10	1.3	8	1.0
80 and under 90 cents	....	....	6	.8	4	.5
90 cents and under $1	2	.3	2	.3	3	.4
$1 and over	12	1.5	8	1.1	11	1.3
Total	789	100.0	747	100.0	831	100.0
Under 18 cents	299	37.9	299	40.0	236	28.4
18 and under 25 cents	222	28.1	221	29.6	280	33.7
25 cents and over	268	34.0	227	30.4	315	37.9
Total	789	100.0	747	100.0	831	100.0

The following table shows in cumulative form for 1900 and 1910 the data presented in the preceding table:

CUMULATIVE NUMBER AND PER CENT OF EMPLOYEES EARNING EACH SPECIFIED AMOUNT AND OVER PER HOUR, BAR MILLS, 1900 AND 1910.

[Figures are for 5 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Hourly earnings.	1900		1910	
	Number.	Per cent.	Number.	Per cent.
14 cents and over	654	82.9	774	93.1
16 cents and over	576	73.0	738	88.8
18 cents and over	490	62.1	595	71.6
20 cents and over	386	48.9	495	59.6
25 cents and over	268	34.0	315	37.9
30 cents and over	207	26.2	207	24.9
40 cents and over	124	15.7	116	14.0
50 cents and over	73	9.3	57	6.9
60 cents and over	45	5.7	43	5.2
70 cents and over	41	5.2	26	3.1
80 cents and over	14	1.8	18	2.2
90 cents and over	14	1.8	14	1.7
$1 and over	12	1.5	11	1.3

ROD MILLS.

The number of employees in productive occupations in the rod mills decreased considerably between 1900 and 1910. This was due principally to the use of improved furnaces and to the introduction of better methods of handling both the billets and the finished product.

In the rod mills many notable changes occurred between the periods reported. In 1900 there were 21.3 per cent of the employees earning less than 16 cents per hour and 34.3 per cent earning 16 and under 18 cents, making the high percentage of 55.6 per cent earning under 18 cents. There were comparatively few—only 15.6 per cent—earning between 18 and 25 cents, and there were considerably more employees earning 60 cents and over than in either of the other periods reported.

In 1905, 39.6 per cent of the employees were working for less than 16 cents per hour and 56.5 per cent under 18 cents, while those in the highest grade reported, $1 and over per hour, had decreased from 15 employees to 1 employee.

In 1910 those earning the lower classified amounts formed a still smaller percentage of the total force, while those earning the higher rates had increased over 1905, although none were earning as much as $1 per hour.

The following table shows the number and per cent of employees earning each classified amount in rod mills in 1900, 1905, and 1910:

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR, ROD MILLS, 1900, 1905, AND 1910.

[Figures are for 7 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Classified hourly earnings.	1900		1905		1910	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 14 cents	49	3.7	81	6.4	12	1.1
14 and under 16 cents	230	17.6	419	33.2	48	4.2
16 and under 18 cents	449	34.3	214	16.9	265	23.2
18 and under 20 cents	53	4.0	88	7.0	154	13.5
20 and under 25 cents	151	11.5	112	8.9	122	10.7
25 and under 30 cents	73	5.6	86	6.8	92	8.1
30 and under 40 cents	102	7.8	83	6.6	178	15.6
40 and under 50 cents	62	4.7	98	7.8	95	8.3
50 and under 60 cents	42	3.2	43	3.4	104	9.1
60 and under 70 cents	42	3.2	22	1.7	48	4.2
70 and under 80 cents	28	2.1	9	.7	7	.6
80 and under 90 cents	9	.7	7	.6	10	.9
90 cents and under $1	4	.3			6	.5
$1 and over	15	1.1	1	.1		
Total	1,309	100.0	1,263	100.0	1,141	100.0
Under 18 cents	728	55.6	714	56.5	325	28.5
18 and under 25 cents	204	15.6	200	15.9	276	24.2
25 cents and over	377	28.8	349	27.6	540	47.3
Total	1,309	100.0	1,263	100.0	1,141	100.0

The following table presents in cumulative form for 1900 and 1910 the data shown in the preceding table:

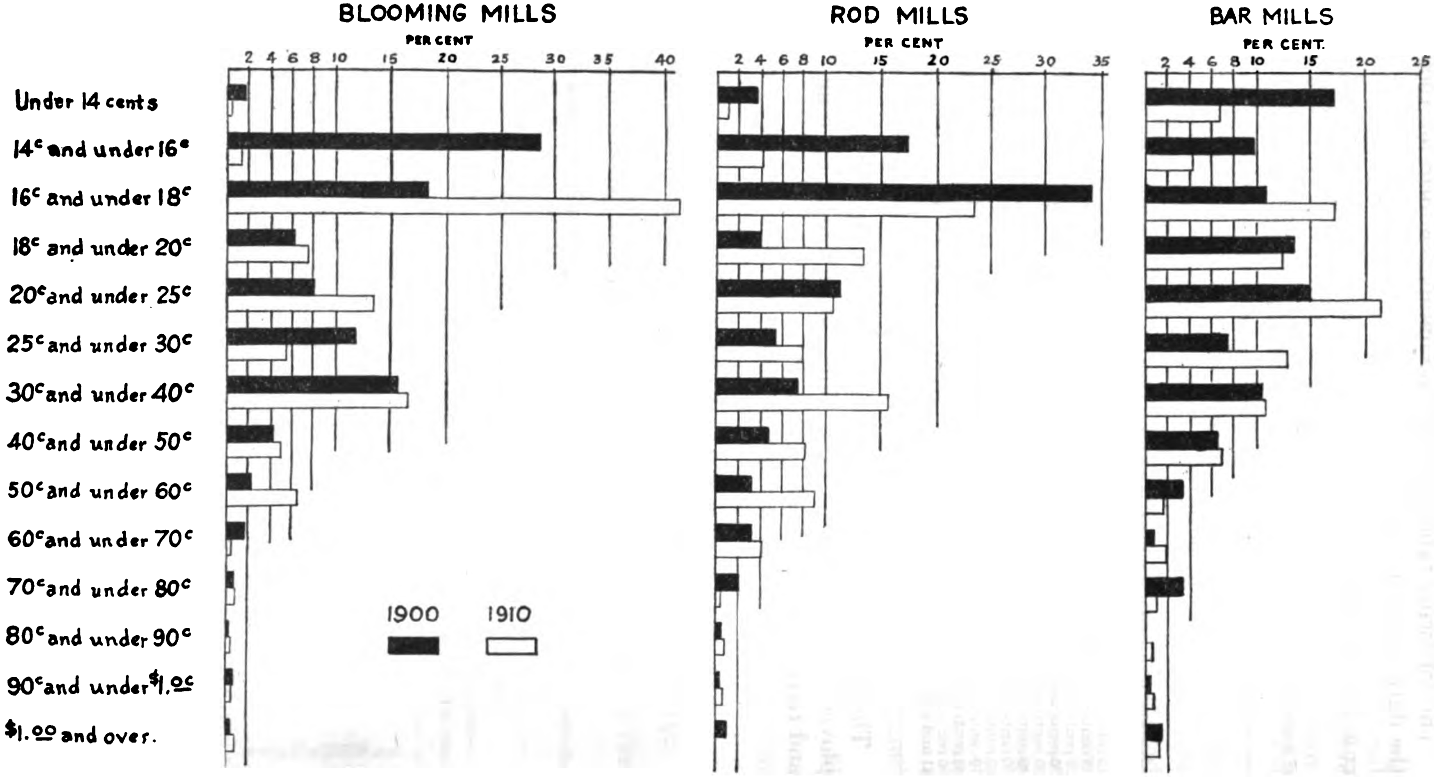
CUMULATIVE NUMBER AND PER CENT OF EMPLOYEES EARNING EACH SPECIFIED AMOUNT AND OVER PER HOUR, ROD MILLS, 1900 AND 1910.

[Figures are for 7 plants submitting comparable data. Foremen, clerks, timekeepers, weighers, chemists, and chemists' assistants are omitted.]

Hourly earnings.	1900		1910	
	Number.	Per cent.	Number.	Per cent.
14 cents and over	1,260	96.3	1,129	98.9
16 cents and over	1,030	78.7	1,081	94.7
18 cents and over	581	44.4	816	71.5
20 cents and over	528	40.3	662	58.0
25 cents and over	377	28.8	540	47.3
30 cents and over	304	23.2	448	39.3
40 cents and over	202	15.4	270	23.7
50 cents and over	140	10.7	175	15.3
60 cents and over	98	7.5	71	6.2
70 cents and over	56	4.3	23	2.0
80 cents and over	28	2.1	16	1.4
90 cents and over	19	1.5	6	.5
$1 and over	15	1.1	....	....

The following diagram shows in graphic form the per cent of employees earning each classified amount in blooming mills, bar mills, and rod mills in 1900 and 1910.

PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT PER HOUR IN BLOOMING, ROD, AND BAR MILLS, 1900 AND 1910.



HOURLY WAGE RATES, 1901 TO 1910, COMMON LABOR.

The unskilled workmen, generally known in the industry as "common laborers," constitute about one-half of the entire labor force of the iron and steel industry. At least three-fourths of the common laborers are foreign born. At present the common laborers are recruited almost entirely from among the recently arrived immigrants from the eastern and southeastern parts of Europe. The supply is very great and may be increased at any time by simply raising the rate of wages a cent or two an hour. The demand varies in proportion to the growth and activity of the industry.

The common-labor rate of wages is of the greatest significance not only because of the very large number of men to whom it applies, but also because in a very definite sense it is indicative of the trend of wages in the industry as a whole. It has already been pointed out that the wage rates of the highly skilled employees during the 10 years, 1901 to 1910, have not varied uniformly with the rate for common laborers. These highly paid employees, however, constitute only a small fraction of the total force, while the semiskilled workmen, whose rates fluctuate very nearly as do the rates paid common laborers, form a large and highly important part of the force. In general, therefore, the common-labor rate forms a valuable index of the wages which the majority of the workmen in the iron and steel industry receive.

In nearly all of the plants, both large and small, a single standard rate is paid for the services of unskilled workmen regardless of the qualifications of the individual. In a few plants the unskilled workmen are roughly graded into two or more classes, to whom different rates of wages are paid, but this is far from being the custom. Furthermore, the rates paid common laborers in any given locality are generally fairly uniform. There are, of course, single plants here and there in which a rate either higher or lower than the customary rate is paid. Thus some managers carefully select their unskilled laborers, and in order to maintain a high standard find it necessary to pay slightly more than the rate prevailing in the district. Other managers, however, are satisfied to employ almost any adult who applies for a position, paying, of course, much less than the prevailing rate in the district. Cases of the latter kind, however, are exceptional, and within any comparatively small area the rates paid for common labor do not ordinarily vary more than one or two cents per hour from the prevailing rate.

The following table shows the average rate per hour paid common laborers in each of the years from 1901 to 1910. Complete statements were secured from 49 plants, showing the rates paid common laborers in each year from 1901 to 1910, together with the exact dates on which changes in rates were made. From these data a table was made showing for each plant the rate prevailing during the greater part of each half year. The average rates shown in the table presented below were calculated from this detailed table, the rates paid in each plant being weighted in calculating the average by the number of employees in 1910. Only plants which were operated under the same management from 1901 to 1910 are included in the table.

AVERAGE AND RELATIVE HOURLY RATES OF WAGES PAID TO COMMON LABORERS IN EACH HALF OF EACH YEAR, 1901 TO 1910.

Year and period.	Average hourly rates of wages (cents).	Relative hourly rates of wages (January to June, 1901=100).	Year and period.	Average hourly rates of wages (cents).	Relative hourly rates of wages (January to June, 1901=100).
1901—January to June	13.7	100.0	1906—January to June	14.3	104.4
July to December	13.8	100.7	July to December	14.4	105.1
1902—January to June	14.0	102.2	1907—January to June	15.1	110.2
July to December	14.5	105.8	July to December	15.1	110.2
1903—January to June	14.5	105.8	1908—January to June	15.1	110.2
July to December	14.5	105.8	July to December	15.1	110.2
1904—January to June	13.7	100.0	1909—January to June	15.0	109.5
July to December	13.7	100.0	July to December	15.1	110.2
1905—January to June	14.0	102.2	1910—January to June	15.2	110.9
July to December	14.3	104.4	July to December	16.1	117.5

It will be seen that the average rate for all companies increased from 13.7 cents in 1901 to 16.1 cents during the last half of 1910, an increase of 17.5 per cent. This increase of 17.5 per cent in the average hourly rates paid common laborers was but little more than half as great as the increase of 32.7 per cent in the retail prices of food during the same period (1901 to 1910).[1] It should be noted also that, as has been shown in the preceding pages of this chapter, the wages of common laborers increased to a greater degree during the 10 years than the wages of any other class of workmen.

The increase in the wages of common laborers was by no means regular, and in 1904 the rates were reduced to such a point that they were the same as in 1901. The rates of wages were gradually increased between 1904 and 1907. During the depression of 1908 a few companies reduced wages, but in most cases wages remained practically stationary until the general increase in 1910.

TONNAGE RATES, EARNINGS, AND OUTPUT OF TONNAGE WORKERS, 1900 TO 1910.

In the preceding discussion of the general trend of wages in the steel industry during the period from 1900 to 1910 it has been shown that the proportion of men earning the higher rates of wages either increased slightly or actually decreased, while during the same period the wages of the other classes of employees increased considerably.

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[1] See table "Relative prices (weighted) of food, 1900 to 1910," p. 232.

The decrease in the proportion of highly paid workmen between 1900 and 1910 was in part due to the fact that improved methods of manufacture displaced a number of the more highly skilled workmen. A principal cause, however, lay in the fact that the tonnage rates in many occupations were reduced to such an extent that even with considerably increased outputs many of the tonnage workers[1] earned less for their day's work in 1910 than in 1900. The reductions in tonnage rates were principally made during the depression of the steel industry in 1904. Consequently by 1905 the earnings of the tonnage workers had been reduced except in a few unusual instances where the output of the mill had been greatly increased between 1900 and 1905. Between 1904 and 1910 the tonnage rates were increased, but in the majority of cases the increases were not sufficient to restore the rates to the level existing in 1900. Practically all of the increases took place either during the early part of 1907 or in May, 1910. Very few changes in tonnage rates were made except at the time of the three general readjustments of wages in the industry, namely, 1904, 1907, and 1910.

The above statements concerning the changes in tonnage rates between 1900 and 1910 are based upon a careful study of a large amount of detailed information, representing for each department 15 or more plants. The information secured showed in detail the number of workmen employed, the rates per ton, and the average daily earnings in each occupation in 1900, 1905, and 1910.

As each plant and each occupation must be considered separately in a study of the earnings of tonnage workers, it is impracticable to present the data for all the plants from which data were secured. For the purpose of presentation, in each department the two plants were selected which had the largest number of employees paid on a tonnage basis.

The results of the study of these selected plants are briefly summarized in the following table. In preparing this table the figures were carefully weighted according to the number of employees in the tonnage-rate occupations in the specified years in order to present a correct index of the changes in output, tonnage rates, and daily earnings.

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[1] Tonnage workers, who are principally skilled workmen, constitute about one-fourth of the employees in the producing departments, and about one-sixth of all the employees in the industry.

RELATIVE OUTPUT, TONNAGE RATES, AND DAILY EARNINGS OF TONNAGE WORKERS, 1900, 1905, AND 1910.

	1900	1905	1910
Number of tonnage workers	644	628	629
Relative output per day	100	109	123
Relative tonnage rates	100	85	87
Relative daily earnings of tonnage workers	100	93	107

It will be seen from the above table that the reductions in tonnage rates between 1900 and 1905 were such that for all departments combined the relative tonnage rates in 1905 were 15 per cent lower than in 1900. The output, however, increased 9 per cent during the five years 1900 to 1905, so that the average daily earnings of the tonnage men were only 7 per cent less than in 1900. In 1910 the relative tonnage rates were 13 per cent less than in 1900, but the output had in the meantime increased 23 per cent, so that the average daily earnings of the tonnage workers were 7 per cent higher than in 1900. It will be noted that the number of employees in the occupations considered decreased slightly, from 644 in 1900 to 629 in 1910.

The changes in tonnage rates and daily earnings varied considerably in the different departments and plants. The nature and degree of the variation is shown in the following table. This table is similar in general form to the preceding table, except that each department and plant is shown separately. The relative figures shown in the table are calculated from averages weighted according to the number of employees in each occupation. The figures for 1900 were in each case used as a base of 100 and the relation of the figures for each of the other years to this base is shown in the table.

RELATIVE OUTPUT, TONNAGE RATES, AND DAILY EARNINGS OF TONNAGE WORKERS IN 1900, 1905, AND 1910, BY DEPARTMENTS AND PLANTS.

Departments and plants.	Number of tonnage workers.			Relative output per day (1900=100).		Relative tonnage rates (1900=100).		Relative earnings per turn[1] (1900=100).	
	1900	1905	1910	1905	1910	1905	1910	1905	1910
Bessemer converters:									
Plant A	47	47	47	105.8	103.0	76.6	80.2	80.4	82.5
Plant B	53	48	48	85.0	86.1	65.7	65.7	58.6	58.7
Open hearth furnaces:									
Plant A	220	218	226	109.8	109.8	90.9	92.9	97.9	102.1
Plant B	66	64	60	133.3	158.7	86.9	85.7	110.9	130.3
Blooming mills:									
Plant A	57	57	54	101.2	158.3	74.4	78.5	75.5	124.2
Plant B	34	30	28	97.6	93.5	90.8	121.7	87.9	118.1
Bar mills:									
Plant A	55	55	55	117.6	138.9	89.8	86.5	105.9	119.6
Plant B	32	28	28	106.5	137.7	84.2	76.1	85.5	106.1
Rod mills:									
Plant A	42	42	42	109.6	154.3	89.3	80.5	98.1	125.7
Plant B	38	39	41	108.1	126.3	88.2	85.9	95.1	108.9

[1] The relative earnings per turn were obtained By two methods: (1) By calculations based on the actual earnings shown on the books of the company; (2) by multiplication of the average daily output and the tonnage rates. The results were identical in most cases, but owing to the dropping of fractional parts, etc., in making the calculations the results of the two methods in some cases differed slightly. In no case was this difference more than 1 per cent, and wherever such difference occurred the result based on the actual earnings is shown.

It will be seen that the tonnage rates were reduced between 1900 and 1905 in each of the plants included in the table. In the majority of cases reductions amounted to less than 15 per cent, but in one of the Bessemer converting plants tonnage rates were reduced by 34.3 per cent. This latter reduction was due to extensive alterations in equipment which did not increase the output but rendered easier the operation of the plant. The reductions in tonnage rates between 1900 and 1905 were such that in only two of the plants were the average daily earnings of the tonnage workers as high as they had been in 1900.

Between 1905 and 1910 tonnage rates were generally increased in the steel works and blooming mills, but in the bar mills and rod mills they were decreased. In the case of the bar mills and rod mills, however, the output was so greatly increased between 1905 and 1910, that the earnings were also increased. The increase in output was due chiefly to the installation of improved furnaces capable of supplying properly heated billets as rapidly as they could be rolled. Certain minor changes were also made in the equipment of these mills to facilitate the handling of material and products. No changes were made, however, in any of the four mills shown here which to any considerable degree affected the severity of the work performed by the members of the rolling crew, who were for the most part tonnage workers. The increase in output between 1905 and 1910 in the bar mills and rod mills, therefore, represents an almost proportional increase in the amount of work performed by the members of the rolling crew. Consequently, although their average daily earnings had considerably increased in 1910 as compared with either 1905 or 1900, they were performing a larger amount of work in return for their wages. The only department in which the earnings were lower in 1910 than in 1900 was the Bessemer department. While it is extremely difficult to determine the reasons for wage changes it seems highly probable that the lower wages in the Bessemer department in 1910 as compared with earlier years may be attributed to the decline in the use of Bessemer converters. Within the past 10 years a considerable number of Bessemer plants have been definitely abandoned or are operated only under conditions of unusual demand. The tendency of this has been to leave a large number of workmen trained to perform a highly specialized work in the Bessemer departments without permanent positions. In other words, the supply of trained Bessemer workers within the last few years has considerably exceeded the active demand for them. This is indicated also in the columns of the iron trade journals where applications for positions by Bessemer workers are frequently found, while there are almost no instances in which manufacturers have to advertise to secure workmen for their Bessemer departments.

The reductions in tonnage rates between 1900 and 1910 affected principally the more highly paid workmen. This is shown in the following table, in which the employees in occupations earning less than $3 per turn in 1900 are shown separately from those earning higher amounts. Relative tonnage rates only are shown in this table, because as the output for all classes of employees in a given department is the same the relative daily earnings would consequently bear the same relations to each other as the tonnage rates.

RELATIVE TONNAGE RATES, 1905 AND 1910 COMPARED WITH 1900, OF EMPLOYEES IN OCCUPATIONS PAID LESS THAN $3 PER TURN AND OF THOSE PAID $3 AND OVER PER TURN IN 1900, BY DEPARTMENTS AND PLANTS.

Departments and plants.	Tonnage workers in occupations paid less than $3 per turn in 1900.					Tonnage workers in occupations paid $3 and over per turn in 1900.				
	Number in—			Relative tonnage rates (1900=100).		Number in—			Relative tonnage rates (1900=100).	
	1900	1905	1910	1905	1910	1900	1905	1910	1905	1910
Bessemer converters:										
Plant A	......	......	......	......	......	47	47	47	76.6	80.2
Plant B	......	......	......	......	......	53	48	48	65.7	65.7
Open-hearth furnaces:										
Plant A	172	170	178	89.7	124.0	48	48	48	91.4	96.3
Plant B	14	14	14	83.1	73.1	52	50	46	82.5	97.8
Blooming mills:										
Plant A	12	15	15	83.1	115.2	45	42	39	74.4	78.4
Plant B	14	12	10	95.8	127.6	20	18	18	88.1	115.3
Bar mills:										
Plant A	28	28	28	94.1	94.1	27	27	27	87.4	82.3
Plant B	8	6	6	90.7	80.5	24	22	22	82.2	74.7
Rod mills:										
Plant A	2	2	2	122.5	127.5	40	40	40	88.2	79.0
Plant B	......	......	......	......	......	38	39	41	88.2	85.9

It will be seen that except in the open-hearth furnace, plant B, the reduction of tonnage rates was much larger in the case of employees earning $3 and over per turn. This is a part of the general policy, which has been previously commented upon, of reducing wages in the steel industry to a much more nearly uniform level than was formerly the case.

In the study of the data regarding tonnage rates and output which were collected in the course of this investigation considerable attention was devoted to the question of whether or not tonnage rates had been reduced in order to increase the speed of the workmen and thereby secure larger outputs. Such a question as this involves the interrelations of a large number of factors. Without the possession of complete data it is extremely difficult to determine whether wages were reduced after important changes had been made in the equipment of the mill in order to compensate for the great increase in output which had been secured without extra exertion on the part of the workmen, or, on the other hand, whether the increase in output was the result of increased exertion on the part of the workmen in an attempt to maintain their daily earnings at the level which they had received before the tonnage rates were reduced. As a result of the study of the comparatively large amount of data secured during this investigation the conclusion was reached that while in a few instances it was apparent that tonnage rates had been reduced with the object of securing increased exertion on the part of the workmen and thereby increasing the output of the mills, for the industry as a whole no such policy has been in vogue at least during the past decade. The conclusion rests largely upon certain fundamental considerations which may be briefly stated.

In the first place the reductions of tonnage rates were made almost without exception at the same time that the wages of employees paid on an hourly basis were reduced. The actual reductions for the most part were made in 1904 when a general depression occurred and wages were reduced throughout the industry for all classes of employees. Second, in almost every case the reductions of tonnage rates took place after a considerable increase in output had already been secured. Third, in the majority of cases no increases in output took place until a considerable time after the tonnage rates had been reduced. Fourth, it was found almost without exception that where increases in output had been secured they could be traced either to some improvement in the equipment or to a change in the method of operation. As has been pointed out in connection with the hand mills these changes in many cases involved increased exertion on the part of the workmen, but at the same time the increases were not in any direct sense the result of the initiative of the workmen. In many such cases it is true that the workmen did not receive an increase in their earnings proportionate to their increased exertion, but this is an entirely different matter from a policy of reducing tonnage rates in order to urge the workmen to increase their exertions.

In connection with this subject it is necessary to point out that the changes in equipment and in the method of operation by which larger production is secured are frequently of such a nature as to escape the attention of persons not thoroughly acquainted with the industry and familiar with the history of its technology. For example, in the sheet mills the increases in output which have been secured during recent years have been secured largely through the enlargement of the rolls and the use of heavier housings; such changes would almost certainly escape the notice of the casual observer and would be without significance even if they were perceived. In other mills the installation of a crane, a simple runway, or some other minor mechanical device frequently greatly increases the output of the mill at the same time it lightens the work of the employees. Furthermore, the character of the work itself has considerably changed in some occupations within the last 10 years. Miscellaneous tasks that were formerly performed by an employee in connection with his regular duties are now commonly performed by a special employee who is assigned to do this work for a number of mills. In this way the work of an employee is frequently lightened and his tonnage rate is accordingly reduced.

In Appendix M, page 576, tables are published showing for each of the departments and plants considered above the number of employees, hours of labor, tonnage rates, and daily earnings for each of the occupations in which tonnage rates were paid in 1900, 1905, and 1910. In connection with each plant the average output in each of the years is also shown. These detailed data are presented for the assistance of those who are interested in a further study of the general subject of tonnage rates.

CHAPTER X.

COMPARISON OF EARNINGS OF WORKMEN OF THE UNITED STATES STEEL CORPORATION, LARGE INDEPENDENT COMPANIES, AND SMALL COMPANIES.

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During the 20 years 1890 to 1910, the evolution of the iron and steel industry combined with a series of financial consolidations to produce three clearly distinct types of ownership organization. These are (1) The United States Steel Corporation; (2) the large independent companies; and (3) small independent companies.[1] It is the purpose of this chapter to compare the earnings of employees in these three groups of companies.

The United States Steel Corporation manufactures approximately one-half of the products of the industry, and although for operating purposes it is simply a group of large subsidiary companies, the general labor conditions of the subsidiaries are so definitely controlled by the central office of the corporation that for the present purposes it may be regarded as a single unit.

The large independent companies are all of the corporate type of organization, but differ from the Steel Corporation not only in size but in certain features of organization and management, which to a considerable extent influence labor conditions.

There is, of course, no hard and fast line separating the large independent companies from the small companies. For the purposes of the present study the division was based on the number of workmen employed, and this was found to afford a satisfactory basis of separation. Ten companies are included in the classification "Large independent companies," each having a total of 4,000 or more employees in its various plants. The largest of the small companies had only about 2,500 employees in the departments which are under consideration. Four of these large independent companies are owned, or in large part controlled, by railroads, two being under the control of a single large railroad corporation, which owns a majority of their stock. In the case of these companies, however, the control over operating conditions through the medium of stock ownership is by no means as definite and direct as is the control of the Steel Corporation over its subsidiaries.

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[1] Practically all these companies are corporations, ownership by individuals and partnerships being almost nonexistent. The Abstract of Statistics of Manufactures of the United States (Bulletin of the Bureau of the Census), 1910, p. 24, shows that in 1909 98.7 per cent of the pig iron and 99.5 per cent of steel works and rolling mill products were produced in establishments owned by corporations.

Although practically all of the small companies are corporations, since a large amount of capital is required to operate even a very small steel plant, none of them are highly organized, and the working conditions in them are generally under the control of the local manager or other executive officer. For this reason, so far as labor conditions are concerned, these small companies may be considered as representing in large measure a type of individual ownership and control.

In attempting to compare the earnings of employees in the three groups of companies, it is highly important to note that comparisons of the three groups as units may not be made legitimately. In order to render any such comparison fair and just, it is necessary to isolate the factor of company ownership by eliminating all other factors which do not operate uniformly in each of the three groups. To do this requires, substantially, that comparisons be limited to employees of the same department in plants located in the same industrial district. Thus the prevailing rates of wages in the Southern and Eastern districts are decidedly lower than in the Pittsburgh and the Great Lakes and Middle West districts, and the cost of living is likewise somewhat lower. As a very large proportion of the small companies are located in the low-wage districts, while the plants of the Steel Corporation are largely located in the high-wage districts, a comparison of the earnings of their employees for all districts combined would be misleading. In the discussion which follows, therefore, the comparison is limited entirely to the Pittsburgh district, which is of small area, but embraces a large number of the plants belonging to all three groups of companies.

Even in the comparatively small area of the Pittsburgh district there are various local conditions, such as the size of the towns and cities in which the plants are located, their proximity to large cities, the character of the surrounding country and numerous similar factors which largely influence the cost of living and thus indirectly determine the rate of wages. It is impossible, of course, to give adequate consideration to such widely varying and generally intangible conditions, but it seems probable that because of the comparatively uniform distribution of the plants of the various groups of companies over the entire district such factors as these would have little influence on the rate of wages.

Subject to the limitations noted above, a comparison between the three groups of companies in the matter of employees' earnings is valid and of considerable significance. In making the comparison it is not to be understood that the earnings are entirely uniform within each group. On the whole, however, the rates paid within each group of companies tend toward a certain uniformity. The variations which occur are due largely to the varying ideas and policies of the several plant managers rather than to factors which can be considered in a statistical study. As an example of such variation the following may be cited: In the Pittsburgh district, taking the hourly rates paid by the Steel Corporation plants for each locality as a standard, there are certain independent plants located in the immediate vicinity and manufacturing precisely the same general class of products which pay very much lower rates for unskilled labor than the plants of the Steel Corporation. On the other hand, there are several plants similarly located which pay as high rates of wages as the Steel Corporation plants with which they are directly comparable. Considering the groups as a whole, however, the plants of the Steel Corporation in the Pittsburgh district pay appreciably higher hourly rates for unskilled labor than either the large or small independent companies. The higher rate paid for unskilled labor by the plants of the Steel Corporation, while influenced by a number of factors, is in large part determined by the fact that a more rigid selection, particularly as regards age, is made by the Steel Corporation plants. This restriction on age, which is largely the result of the establishment of the pension and voluntary accident funds, is covered in at least two of the subsidiary companies by a definite rule that no unskilled workman over 35 years of age is to be employed. In many of the other plants there is a general rule of a similar character which is uniformly enforced, except when laborers are very scarce and the requirements can not be fulfilled.

In making the study of the comparative earnings of employees in the three groups of companies, the basis of comparison adopted is that of hourly earnings. As the hours of labor in different plants differ very considerably, it is obvious that daily or weekly earnings are not a satisfactory basis for such a comparison. Hourly rates may be lower in mill A than in mill B, but owing to a longer schedule of working hours weekly earnings may be higher. Thus a comparison by weekly earnings tends to favor the establishment working the longest hours.

The following table forms the basis for a comparison of the earnings of the employees of the three groups of companies. In this table only the six principal producing departments are considered. The table shows by means of cumulative percentages the per cent of employees earning each specified amount and over per hour.

COMPARATIVE HOURLY EARNINGS OF EMPLOYEES OF THE STEEL CORPORATION, LARGE INDEPENDENT COMPANIES, AND SMALL COMPANIES, IN THE PRINCIPAL PRODUCING DEPARTMENTS, PITTSBURGH DISTRICT, MAY, 1910.

Department of industry and class of organization.	Number of employees.	Per cent of employees earning per hour—							
		14 cents and over.	16 cents and over.	18 cents and over.	20 cents and over.	25 cents and over.	30 cents and over.	40 cents and over.	50 cents and over.
BLAST FURNACES.									
Steel Corporation	5,249	99.5	98.7	46.0	22.1	8.0	2.4	0.1	......
Large independent companies	3,011	92.5	88.1	46.9	27.5	11.2	4.5	.3	......
Small companies	3,609	97.4	93.9	42.2	23.0	8.8	3.9	.4	(1)
Total	11,869	97.1	94.6	45.1	23.7	9.0	3.4	.3	(1)
BESSEMER CONVERTERS.									
Steel Corporation	1,945	98.8	98.2	57.4	42.2	27.2	16.4	8.6	4.4
Large independent companies	1,226	99.6	89.6	58.2	52.2	43.8	32.4	15.5	4.8
Total	3,171	99.1	94.9	57.7	46.1	33.6	22.6	11.2	4.5
OPEN-HEARTH FURNACES.									
Steel Corporation	3,778	95.4	94.3	63.3	54.5	31.8	18.2	7.2	1.8
Large independent companies	1,830	88.7	78.2	51.4	41.6	24.2	13.4	6.2	.9
Small companies	1,109	96.6	86.5	46.0	36.0	21.7	14.7	4.8	1.6
Total	6,717	93.8	88.6	57.2	48.0	28.1	16.3	6.5	1.5
BLOOMING MILLS.									
Steel Corporation	1,627	96.5	95.1	61.5	53.0	39.5	31.5	12.5	7.6
Large independent companies	896	95.9	89.3	74.2	62.5	51.1	40.5	19.9	8.7
Small companies	216	96.8	94.9	64.8	45.8	31.0	17.6	11.6	6.0
Total	2,739	96.3	93.2	65.9	55.5	42.6	33.4	14.8	7.8
PLATE MILLS.									
Steel Corporation	1,310	97.4	96.6	70.4	59.4	43.7	23.7	9.8	6.3
Large independent companies	1,137	92.9	84.7	72.6	64.7	46.2	33.6	14.2	9.6
Small companies	733	93.3	86.8	48.6	37.2	22.2	14.5	7.6	3.4
Total	3,180	94.8	90.1	66.2	56.2	39.7	25.1	10.8	6.8
BAR MILLS.									
Steel Corporation	3,761	97.3	96.5	69.2	51.5	29.7	22.1	12.8	7.6
Large independent companies	3,389	95.2	85.2	68.0	60.3	46.6	35.6	20.1	10.1
Small companies	1,540	98.2	82.2	63.0	55.3	33.7	25.1	15.8	8.9
Total	8,690	96.6	89.1	67.6	55.6	37.0	27.9	16.2	8.8

[1] Less than one-tenth of 1 per cent.

In making the comparison it is desirable, in order to avoid confusion, to consider only two groups of companies at a time. Comparing first the hourly earnings of the employees of the Steel Corporation and the large independent companies, the following statements may be made:

1. The Steel Corporation plants have a smaller proportion of employees who are paid the lower rates of wages than the plants of the large independent companies. In each of the six departments the Steel Corporation has the higher percentage earning 16 cents and over per hour, the difference being marked. So far as this table can show this might be due to the fact that the corporation plants, owing to superior equipment, require a smaller proportion of unskilled

laborers, but it will be shown later that the actual rates paid by the corporation for such labor are higher.

2. The Steel Corporation plants have, as a rule, a smaller proportion of highly paid workmen (30 cents and over per hour). Except in the open-hearth department, the corporation plants have a smaller proportion of workmen who earn as much as 30 cents per hour than the large independent companies. The corporation plants also have a smaller proportion earning as much as 40 and as much as 50 cents per hour, except in the open-hearth department. This larger proportion of highly paid men in the large independent companies may in part be ascribed to the greater prevalence of the 8-hour system in the Bessemer converters and rolling mills of those companies. It may be noted that the effect of the 8-hour system is twofold:

(*a*) A man working 8 hours a day is regularly paid a higher hourly rate for the same work than one who works 12 hours a day.

(*b*) Since the 8-hour system is generally applied only to the skilled workmen, the presence of three shifts for each skilled position under the 8-hour system tends to increase the proportion of highly paid men.

3. The Steel Corporation plants also have a smaller proportion of workmen who are paid what may be called the "intermediate rates of wages" than the large independent companies. Except in open-hearth furnaces the table shows for the corporation a smaller per cent of employees earning as much as 20 and 25 cents, respectively. The points noted with regard to the 8-hour system apply, but with less force, to these semiskilled workmen.

A comparison of the hourly earnings of employees of the Steel Corporation and the small companies in the different departments produces the following conclusions:

1. The Steel Corporation plants have a smaller proportion of employees earning the lower rates of wages than the plants of the small companies. In each of the five departments in which both groups of companies are represented the Steel Corporation has a larger percentage of employees earning 16 cents and over per hour than the small companies. The difference is most marked in the plate mills and bar mills. The Steel Corporation also has a larger proportion of employees earning 18 cents and over per hour except in the blooming mills, where the difference is slight. The smaller proportion of men in the plants of the Steel Corporation receiving the lower rates of wages is due not only to the fact that unskilled laborers are paid a higher hourly rate of wages, but to the superior mechanical equipment of the corporation plants, which makes it possible to dispense with a number of unskilled laborers performing heavy manual labor, who are required to handle materials and products in the plants of the small companies.

2. The Steel Corporation plants have a larger proportion of employees earning the higher rates of wages (30 cents per hour and over) in the open-hearth furnaces, blooming mills, and plate mills, but not in the blast furnaces and bar mills.

3. Taking the five departments together, the general level of hourly earnings is higher in the plants of the Steel Corporation than in the plants of the small companies.

The final comparison is between the rates of wages paid by the large independent companies and the small companies. The results of such a comparison may be briefly summarized as follows:

1. The small companies have a smaller proportion of employees earning the lower rates of wages. In every department except the bar mills the small companies have a larger per cent earning 16 cents and over per hour than the large independent companies. This is due, as will be shown later, to the fact that the small companies pay their unskilled laborers higher rates of wages than the large independent companies.

2. Except for the unskilled laborers the general level of hourly earnings is higher for the employees of the large independent companies than for those of the small companies. This is in part due to the greater prevalence of the 8-hour system in the plants of the large independent companies.

The classified hourly earnings presented above, while giving a satisfactory general survey of the earnings of employees in the different groups of companies, do not definitely show how the rates of wages paid for the same work by the different groups of companies compare. As was pointed out above, it is not possible to determine from this table of classified earnings whether the fact that any group of companies has a smaller proportion earning the lower rates of wages (under 16 cents per hour) is due to its paying more for the same work, or to the fact that its equipment is such that a smaller proportion of such unskilled workmen is required. It is particularly important to have definite information on this point with regard to the unskilled laborers, both because they form so large a part of the working force and because they are most readily displaced by the introduction of labor-saving machinery. The following table shows for the unskilled laborers in the blast furnaces of the Pittsburgh district the average hourly rate of wages paid by the three groups of companies, together with the classified rates paid.

AVERAGE AND CLASSIFIED HOURLY EARNINGS OF LABORERS[1] IN BLAST FURNACES OF PITTSBURGH DISTRICT, BY GROUPS OF COMPANIES, MAY, 1910.

	Steel Corporation.	Large independent companies.	Small companies.
Number of laborers	600	566	984
Average hourly earnings	$0.171	$0.159	$0.163
Per cent of laborers earning per hour—			
12.5 and under 13 cents	....	....	5.0
13.0 and under 13.5 cents	....	0.2	....
13.5 and under 14.0 cents	....	25.4	....
14.0 and under 14.5 cents	....	....	....
14.5 and under 15.0 cents	....	.7	....
15.0 and under 15.5 cents	....	....	1.1
15.5 and under 16.0 cents	....	3.5	.4
16.0 and under 16.5 cents	0.7	25.3	29.8
16.5 and under 17.0 cents	26.8	....	33.8
17.0 and under 17.5 cents	30.8	44.9	29.9
17.5 cents and over	41.7	....	....

[1] This does not include all the unskilled workmen employed by these companies, but only those definitely classed as laborers.

The highest average rate for unskilled laborers is paid by the Steel Corporation and the lowest by the large independent companies. It should be noted, however, that the low average for the large independent companies is in a large measure due to the fact that one company with 144 laborers in its blast furnaces paid very low wages (13.8 cents per hour). It has already been pointed out that the Steel Corporation in return for the higher rates of wages paid its unskilled workmen exercises a more rigid selection.

CHAPTER XI.

RELATION OF WAGES TO PROFITS AND COSTS.

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RELATION OF WAGES TO PROFITS AND COSTS.

INTRODUCTION.

In a study of wages it is of the greatest importance that consideration be given to the relationship of wage expenditures to the earnings of the industry and to the relationship of labor cost to the total cost of production. It is these relationships which determine what effects increases of wages will have upon profits and cost of production. For example, if wages alone constitute practically all the expenses of an industry, an increase in wages will diminish the profits in almost equal degree. If, however, the manufacturing and operating expenses other than wages are proportionately large, a considerable increase in wages can be made with comparatively little reduction in profits.

This point may be illustrated by an example: If wages constitute 80 per cent of the total receipts of an industry and other manufacturing expenses amount to 10 per cent, leaving 10 per cent for profits, an increase of 10 per cent in wages will bring the proportion of total receipts allotted to wages to 88 per cent, and other manufacturing and operating expenses remaining 10 per cent; this will leave only 2 per cent for profits. On the other hand if, as in the steel industry, wages amount to only 25 per cent of the total receipts and other manufacturing expenses amount to 50 per cent, leaving approximately 25 per cent for the payment of interest and profits, an increase of 10 per cent in wages will reduce the percentage payable to the account of interest and profits by only 2.5 per cent.

The present chapter is devoted to a consideration of the two suggested problems—the effect of variations in the expenditures for wages upon profits and the effect of such variations upon the cost of production. As the two questions are approached from quite different points of view, they will be discussed separately.

RELATION OF WAGES TO PROFITS.

For a study of the relation of wages to profits it is necessary to have detailed information regarding the various items of income and expenditure. Such information was not obtainable for the iron and steel industry as a whole, but was obtainable for the United States Steel Corporation and for one large independent company. The Steel Corporation furnishes approximately one-half of the entire output of the industry and embraces all branches of the industry from the extraction of the raw materials to the delivery of the finished products. Because of this dominance of the Steel Corporation in the industry, the data mentioned is sufficient for a very complete study of the subject of wages and earnings.

UNITED STATES STEEL CORPORATION.

The data upon which this section is based are derived from the Report of the Commissioner of Corporations on the Steel Industry, Part I, July 1, 1911, and from the Annual Reports of the United States Steel Corporation.

In the following table are shown the total receipts from all sources and the items of expense and profit grouped under six principal accounts for each of the 10 years 1902 to 1911, inclusive:

TOTAL RECEIPTS FROM ALL SOURCES AND EXPENSES AND PROFITS OF THE UNITED STATES STEEL CORPORATION, 1902 TO 1911.[1]

[Compiled from Annual Reports of the United States Steel Corporation.]

Item.	1902	1903	1904	1905	1906
Total receipts from all sources	$569,065,902	$541,841,465	$448,162,380	$591,388,870	$705,916,790
Expenses and profits:					
Wages and salaries	120,528,343	120,763,891	99,778,276	128,052,955	147,765,540
Other manufacturing and operating expenses	290,880,475	288,504,708	253,849,039	311,960,477	369,318,415
General expenses	18,234,736	16,847,852	16,013,394	18,570,374	22,907,679
Interest on bonds, and depreciation, replacement, and sinking funds	49,115,823	60,308,361	48,254,142	64,219,572	67,796,569
Dividends	56,052,868	43,111,736	25,219,677	25,219,677	35,385,727
Surplus	34,253,657	12,304,917	5,047,852	43,365,815	62,742,860
Total expenses and profits	569,065,902	541,841,465	448,162,380	591,388,870	705,916,790

Item.	1907	1908	1909	1910	1911
Total receipts from all sources	$766,763,718	$488,094,725	$653,200,250	$709,814,593	$618,911,430
Expenses and profits:					
Wages and salaries	160,825,822	120,570,829	151,663,394	174,955,139	161,419,031
Other manufacturing and operating expenses	403,340,955	247,164,273	331,754,448	354,260,649	326,715,443
General expenses	25,395,379	21,001,037	27,786,420	29,863,055	29,554,634
Interest on bonds, and depreciation, replacement, and sinking funds	72,635,998	53,629,872	62,922,293	63,328,565	45,922,026
Dividends	35,385,727	35,385,727	45,551,777	50,634,802	50,634,802
Surplus	69,179,837	10,342,987	33,521,918	36,772,383	4,665,495
Total expenses and profits	766,763,718	488,094,725	653,200,250	709,814,593	618,911,430

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[1] The item of "Total receipts from all sources" includes the amount shown in the profit and loss account of the Steel Corporation under the heads of "Gross sales and earnings," "Net manufacturing gains and losses" (which, it may be noted, has been a gain in each year), and "Other income."

The six items of expense and the manner in which they are obtained are as follows:

"Wages and salaries," including all amounts paid for service, are as shown in the annual reports of the corporation.

"Other manufacturing and operating expenses" is obtained by subtracting the amounts for wages and salaries from the item of "Manufacturing and producing cost and operating expenses" shown in the reports of the corporation.

"General expenses" is abbreviated for the sake of convenience from the corporation's title of "Administration, selling and general expenses, and employees' compensation under the bonus plan (not including general expenses of transportation companies)," and includes also the amounts shown under the item of "Taxes, commercial discounts, and interest."

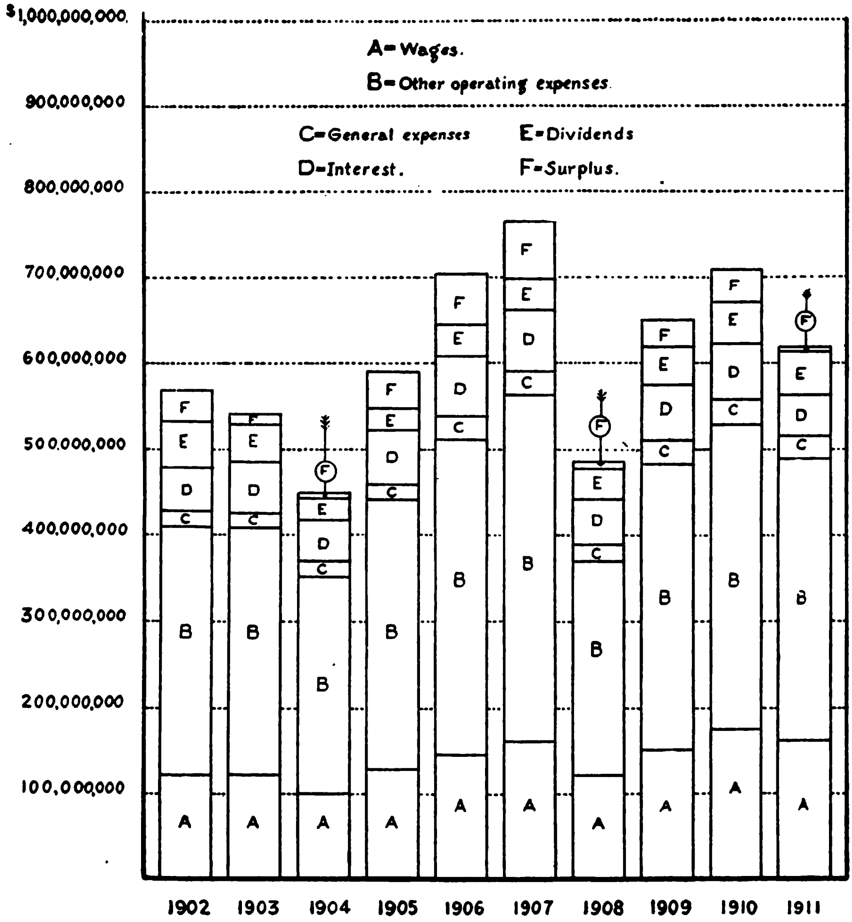
The fourth item of "Interest on bonds, and depreciation, replacement, and sinking funds," is the sum of the various amounts charged against these accounts in the reports of the corporation. It includes, therefore, all of the funds paid or set aside for the payment of the obligations of the corporation on account of the use of borrowed funds or funds obtained through the sale of bonds.

The item of "Dividends" includes the dividends on both common and preferred stock.

The item of "Surplus" is simply the surplus for the given year, the amount of the cumulated surplus and undivided profits being treated in another connection.

The point to which particular attention is here directed is the relatively small part of the total receipts of the corporation which is paid out in the form of wages and salaries. The actual amounts expressed in terms of millions are, of course, enormous; but considered in relation to the total receipts of the corporation, which has ranged from four hundred and forty-eight to seven hundred and sixty-six millions per year, the proportion is small. This will be more clearly seen by a consideration of the chart which follows, in which the amounts expended for each of the particular items are graphically shown for each of the years 1902 to 1911, inclusive:

EXPENSES AND PROFITS OF UNITED STATES STEEL CORPORATION, 1902 TO 1911.



In this chart an entire column indicates for each year the amount of the total receipts of the corporation. The great depressions occurring in 1904 and 1908 and the remarkably prosperous condition enjoyed in 1906, 1907, 1909, and 1910 are thus shown in a striking manner. The effect of depression or prosperity is most clearly seen in the variation of the size of the surplus in each year, but these conditions also affect all the other items to a considerable extent, and particularly the item of wages.

It must be remembered in considering this chart and the figures that what is shown is the total amount expended for wages and salaries and, consequently, a decrease in the amount for this item does not mean necessarily a cut in the rate of wages nor does an increase of this amount indicate anything positive as to an increase in the rate of wages.

The relative importance of labor's share in the total receipts is clearly brought out in the table which follows. The table shows for each of the years since the organization of the Steel Corporation the per cent of the total receipts which has been paid out in wages and salaries and the per cent charged to other items of expense and profits. The same facts are graphically shown in the chart presented on the opposite page.

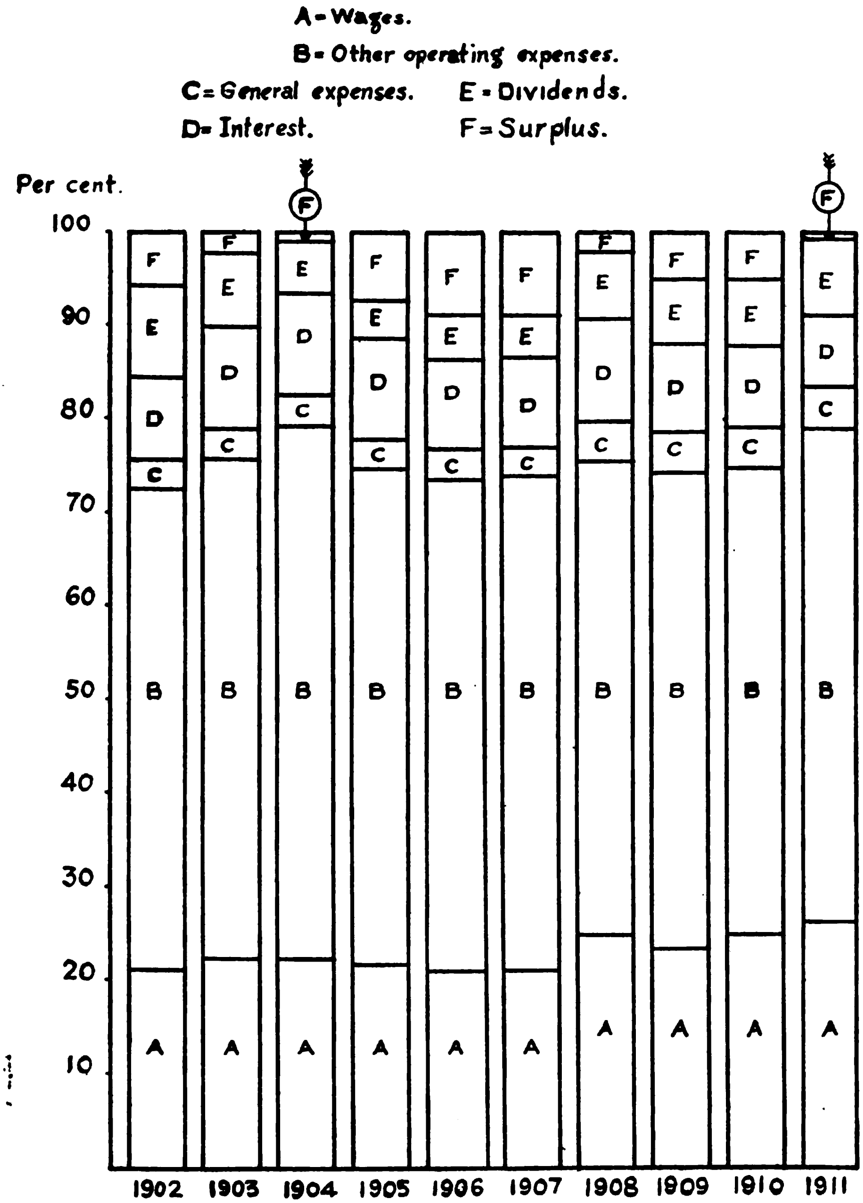
PER CENT OF TOTAL RECEIPTS OF UNITED STATES STEEL CORPORATION CHARGED TO EACH ITEM OF EXPENSE AND PROFIT 1902 TO 1911.

[Compiled from Annual Reports of the United States Steel Corporation.]

Year.	Total receipts, all sources.	Per cent of total receipts of—					
		Wages and salaries.	Other manufacturing and operating expenses.	General expenses.	Interest on bonds, and depreciation, replacement, and sinking funds.	Dividends.	Surplus.
1902	$569,065,902	21.2	51.1	3.2	8.6	9.9	6.0
1903	541,841,465	22.3	53.2	3.1	11.1	8.0	2.3
1904	448,162,380	22.3	56.6	3.6	10.8	5.6	1.1
1905	591,388,870	21.7	52.7	3.1	10.9	4.3	7.3
1906	705,916,790	20.9	52.3	3.3	9.6	5.0	8.9
1907	766,763,718	21.0	52.6	3.3	9.5	4.6	9.0
1908	488,094,725	24.7	50.6	4.3	11.0	7.3	2.1
1909	653,200,250	23.2	50.8	4.3	9.6	7.0	5.1
1910	709,814,593	24.7	49.9	4.2	8.9	7.1	5.2
1911	618,911,430	26.1	52.8	4.8	7.4	8.2	0.7
Average, 1902 to 1911.	609,316,012	22.7	52.2	3.7	9.7	6.6	5.1

It will be seen that the per cent of the total receipts expended for wages and salaries has varied from 20.9 in 1906 to 26.1 in 1911, or, in other words, labor received from one-fifth to one-fourth of the total earnings of the corporation. It is sometimes asserted by persons engaged in the manufacture of steel, and who should, therefore, be well acquainted with the facts, that practically all the expense

PER CENT OF TOTAL RECEIPTS OF UNITED STATES STEEL CORPORATION CHARGED TO EACH ITEM OF EXPENSE AND PROFITS, 1902 TO 1911.



connected with the manufacture of iron and steel products is made up of payments for labor. As a matter of fact, there are few industries in which the capital charges required through the elaborate use of machinery are so great, or in which the proportion received by labor is so small as in the iron and steel industry.[1] The United States Steel Corporation mines its own ores, coal, and limestone, transports practically all its materials, and performs every manufacturing operation from the smelting of the ores to the fabrication of finished products. The amounts expended by the corporation for wages and salaries therefore include every item of the labor cost which can be considered as involved in manufacture. For the ten years 1902 to 1911, this total labor cost, including the wages and salaries paid by the corporation in every branch of its mining, transportation, and manufacturing business, has averaged 25.7 per cent of the total expenses of manufacture, transportation, and mining, and only 22.7 per cent of the total income of the corporation.

Another important comparison which can be made from the above table is that between the proportion of the total receipts paid in wages and salaries and the proportion available as profits. For the purposes of this comparison "profits" is understood as including the sums paid out as dividends or credited as surplus at the end of each year.

The table shows that for the ten years of the Steel Corporation's existence, wages and salaries amounted to 22.7 per cent of the total receipts of the corporation, while dividends and surplus amounted to 6.6 per cent and 5.1 per cent, respectively, giving a total available for profits of 11.7 per cent of the total earnings. Taking the ten years as a whole, therefore, the total amount paid for wages and salaries was only about twice as great as the profits of the corporation.

In the very prosperous years of 1906 and 1907 the proportion of the total receipts expended for wages was smallest, while in 1908, the year of extreme depression, the proportion expended for wages and salaries was the same as in 1910, in spite of an increase of approximately 6 per cent in the rates of wages and salaries paid by the Steel Corporation, which took place in May, 1910. In 1906 and 1907, not only was there an abnormally large production, but the prices of the various products were unusually high. The increase in the per cent which wages were of total receipts in 1911 is due to a combination of the actual advance in the rate of wages in May, 1910, and the fact that 1911 was not a prosperous year, and, as has been shown above in connection with the year 1908, the proportion of the total receipts paid out as wages in such years of depression is relatively larger than in more prosperous years.

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[1] Abstract of Statistics of Manufactures of the United States (Bulletin of the Bureau of the Census), 1910 p. 30.

Another striking feature of the Steel Corporation's operations is the large sum which has been available for surplus in each of the years, with the exception of 1904 and 1911, and even in these years the surplus, although much less than in the prosperous years, amounted to approximately $5,000,000. The surplus, of course, has not been allowed to lie idle, but has very largely been reinvested in additions to the properties of the corporation, particularly in the construction of the new plants at Gary, Ind., and in the creation of a new industrial community at that place. As such expenditures in new property greatly increase the earning capacity of the corporation, are accomplished without any increase in the bonded debt, and are worth at least the full value of the money invested in them, it would be proper to consider amounts so expended as still constituting a part of the accumulated surplus. Even with their total omission, however, the remaining surplus—i. e., the actual undivided surplus—is very large. This is shown in the following table, which gives for each year, 1902 to 1911, the balance of the undivided surplus, and shows the percentage that such surplus is of the expenditures for wages and salaries:

TOTAL EXPENDITURES OF UNITED STATES STEEL CORPORATION FOR WAGES AND SALARIES DURING EACH YEAR AND BALANCE OF UNDIVIDED SURPLUS IN EACH YEAR AFTER PAYMENT OF DIVIDENDS.

[Compiled from Annual Reports of the United States Steel Corporation.]

Year.	Total wages and salaries paid during year.	Balance of undivided surplus, Dec. 31.	Per cent which undivided surplus is of wages and salaries.	Year.	Total wages and salaries paid during year.	Balance of undivided surplus Dec. 31.	Per cent which undivided surplus is of wages and salaries.
1902	$120,528,343	$77,874,597	64.6	1907	$160,825,822	$122,645,244	76.3
1903	120,763,891	66,096,682	54.7	1908	120,570,829	133,415,214	110.7
1904	99,778,276	61,365,446	61.5	1909	151,663,394	151,354,528	99.8
1905	128,052,955	84,738,451	66.2	1910	174,955,139	164,143,158	93.8
1906	147,765,540	97,720,714	66.1	1911	161,419,081	156,274,795	96.8

During each of the 10 years the Steel Corporation has had at the end of the year an undivided surplus equal to more than 50 per cent of its total expenditures for wages and salaries during the same year, and during each of the last four years the undivided surplus has equaled more than 90 per cent of the expenditures for wages and salaries. This undivided surplus in each year represents, of course, the net accumulations of past years. This reserve constitutes a fund from which the corporation may draw largely in improving the working conditions of its employees without at all affecting its dividends and the payment of interest on its bonded debt.

REPUBLIC IRON & STEEL CO.

It is unquestionably true that in the case of the United States Steel Corporation the proportion which wages and salaries bear to the gross receipts is somewhat smaller than for many of the other steel companies. As has been stated above, the data for making a similar showing for the industry as a whole are not available. It is possible, however, to show in the case of the Republic Iron & Steel Co. essentially the same facts that have been given for the Steel Corporation. This company, it may be noted, makes a specialty of manufacturing merchant bars and other finished products on which the labor cost is relatively high. The table which follows, showing in detail the operations of that company from 1906 to 1911, has been compiled from the published reports of the Republic Iron & Steel Co., which are issued annually to the stockholders:

COMPARATIVE STATEMENT OF EXPENSES AND PROFITS OF THE REPUBLIC IRON & STEEL CO., 1906 TO 1911.

[Compiled from Annual Reports of the Republic Iron & Steel Co.]

Item.	1906	1907	1908	1909	1910	1911
Total receipts, all sources	$26,196,439	$31,227,424	$18,693,882	$19,595,944	$28,296,266	$24,071,771
Wages and salaries	7,735,903	8,686,605	5,832,632	5,700,805	8,652,102	8,273,630
Other manufacturing and operating expenses	13,710,060	17,513,077	9,814,631	11,125,992	15,416,795	11,953,141
Gross profits	4,750,476	5,027,742	3,046,619	2,769,147	4,227,369	3,845,000
Depreciation and interest charges	2,011,915	1,298,496	1,075,199	1,139,801	1,324,454	1,422,481
Net profits	2,738,561	3,729,245	1,971,420	1,629,346	2,902,915	2,422,520
Regular dividends	1,429,183	1,429,183	1,071,887	408,338	1,669,796	1,750,000
Amount carried to surplus	1,309,378	2,300,062	899,533	1,221,008	1,233,120	672,520
Amount specially written out of surplus	2,186,424	1,633,352	....	....	2,198,994	264,734
Balance surplus account	3,133,284	3,799,994	4,699,527	5,920,535	4,954,661	5,362,446

It will be seen from this statement that the total receipts from all sources are only about one twenty-fifth as large as in the case of the Steel Corporation, and the proportions which the various items in the distribution of earnings bear to each other are also somewhat different. This is more clearly seen in the following table, which shows for each year the per cent of the gross earnings from all sources which was charged to each item of expense and profit.

PER CENT OF TOTAL RECEIPTS OF REPUBLIC IRON & STEEL CO., CHARGED TO EACH ITEM OF EXPENSE AND PROFIT, 1906 TO 1911.

[Compiled from Annual Reports of the Republic Iron & Steel Co.]

Year.	Total receipts, all sources.	Items of expense and profit in per cent of total receipts.				
		Wages and salaries.	Other manufacturing and operating expenses.	Depreciation and interest charges.	Dividends.	Surplus.
1906	$26,196,439	29.5	52.3	7.7	5.5	5.0
1907	31,227,424	27.8	56.1	4.1	4.6	7.4
1908	18,693,882	31.2	52.5	5.8	5.7	4.8
1909	19,595,944	29.1	56.8	5.8	2.1	6.2
1910	28,296,266	30.6	54.5	4.7	5.9	4.3
1911	24,071,771	34.4	49.6	5.9	7.3	2.8
Average, 1906 to 1911	24,680,288	30.3	53.7	5.6	5.2	5.2

In the case of the Steel Corporation it was shown that wages and salaries constituted from 20.9 to 26.1 per cent, the average for the 10 years being 22.7 per cent. For the Republic Iron & Steel Co., largely on account of the more highly finished character of its products and the consequently greater labor cost, the proportion of wages to gross earnings ranged from 27.8 to 34.4 per cent, the average for the six years being 30.3 per cent. Other manufacturing and operating expenses also constituted a somewhat higher proportion of the gross earnings than in the case of the Steel Corporation, but when the general expenses of administration and selling of the Steel Corporation, for which there is no corresponding item in the case of the Republic Iron & Steel Co., are added to the operating expenses, the proportion for the Steel Corporation is larger than in the case of the Republic Iron & Steel Co. In considering the lower proportions of wages to gross earnings in the case of the Steel Corporation it is proper to take into account the fact that the charges for interest and depreciation are much heavier in the case of the Steel Corporation than in the case of the Republic Iron & Steel Co. These heavier interest charges are in a large part required by the fact that the Steel Corporation has large investments in ore and coal lands which are yet unused and that in many of its plants it has a more elaborate mechanical equipment than the Republic Iron & Steel Co.

The most striking fact developed from the consideration of the operations of this company is that even in the manufacture of finished products, labor receives through wages and salaries less than one-third of the gross earnings of the business. The entire amount paid out in wages and salaries in the case of the Republic Iron & Steel Co. is only about six times as great as the amount which is annually carried to surplus, while in the case of the Steel Corporation it is only about four times as great as the surplus account.

The most important consideration developed by this study of the distribution of the total receipts of the industry is the very small proportion of such receipts which are received by labor in the form of either wages or salaries. As a result of this fact an increase in the rate of wages does not mean a proportionate decrease in profits.

RELATION OF LABOR COST TO THE TOTAL COST OF PRODUCTION.

In the discussion of the relation of wages to gross earnings some idea of the relation of labor cost to the total cost of production was necessarily given. It is important, however, that further consideration should be given to this relation. The recent preliminary report of the Commissioner of Corporations on the cost of production in the steel industry,[1] covering the majority of steel produced in the United States from 1902 to 1906, furnishes material from which a study of this important question can be made. The report referred to shows separately the labor cost involved in each process, but does not show the total cost of the labor entering into the finished products. As the purpose of this study is to develop the latter point, it is necessary to reorganize the material there presented and to make certain additional calculations. For example, the labor cost per ton of converting pig iron into Bessemer ingots is only 57 cents. This, however, is only a very small part of the total labor involved in obtaining Bessemer ingots. Before the process of conversion can take place it is necessary for the ore and the other materials to be mined and to be smelted in blast furnaces. When these underlying costs are taken into consideration the total, or "cumulative," labor cost per ton involved in the production of Bessemer ingots is found to be $3.94, or almost seven times as much as the cost of the labor involved in the particular process of converting pig iron into Bessemer steel.

WORKS LABOR COSTS.

The purpose and methods of this study will be most easily understood if consideration is at first limited to what may be called the "works labor cost," that is, the cost of the labor involved in the production of the particular product from the time that the raw materials are received in the plant. In this case the processes begin with the smelting of pig iron and include every necessary process in the entire course of production. The "works labor cost" and the methods by which it is computed are shown in the table which follows.

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[1] Report of the Commissioner of Corporations on the Steel Industry, Part II. Preliminary Report, January 22, 1912.

The table shows for each of the principal crude and finished products of the industry, the total or cumulative works labor cost, which is the total cost of all labor ordinarily performed within a steel plant in manufacturing the specified product. For example, the processes of manufacture begin with the production of pig iron. The labor performed within the plant in connection with producing pig iron consists of (1) assembling and charging the ore, coke, and limestone, (2) operating the furnaces and auxiliary appurtenances (stoves, engines, and machines) and (3) disposing of the products of the furnaces. The total cost of this labor is 77 cents per ton or 6.4 per cent of the total cost of production of $12.10 per ton. The works labor cost of producing merchant bars, therefore, comprises the cost of all the labor involved in smelting the pig iron, converting the pig iron into Bessemer ingots, rolling the ingots into billets, and finally rolling the billets into merchant bars. The cumulative cost of this labor per ton of bars amounts to $5.44 or 20.5 per cent of the total cost of production.

CUMULATIVE WORKS LABOR COSTS FROM RECEIPT OF RAW MATERIALS TO FINISHED PRODUCT, 1902 TO 1906.

Compiled from Report of the Commissioner of Corporations on the Steel Industry, Part II. Preliminary Report, January 22, 1912. Tons of 2,240 pounds are used.]

Product.	Materials used which are produced in steel works.	1 Labor cost per ton on preceding products in works.	2 Tons of material required per ton of product.	3 Works labor cost on amount of material used per ton of product (1×2).	4 Cost per ton of labor connected with production of product.	5 Cumulative works labor cost per ton of product (3+4).	6 Total integrated cost of production per ton.	7 Per cent which cumulative works labor cost is of total integrated cost (5÷6).
Bessemer pig iron	None				$0.77	$0.77	$12.10	6.4
Bessemer billet ingots	Pig iron	$0.77	1.111	$0.86	.57	1.43	15.47	9.2
Large Bessemer billets	Bessemer billet ingots	1.43	1.111	1.59	.55	2.14	17.90	12.0
Wire rods	Large Bessemer billets	2.14	1.087	2.33	1.53	3.86	[1] 25.25	15.3
Structural shapes	Bessemer billet ingots	1.43	1.176	1.68	2.15	3.83	[2] 24.83	15.4
Bessemer rails	Bessemer rail ingots	1.43	1.176	1.68	1.16	2.84	18.80	15.1
Sheared plates	Slabs [3]	2.14	1.176	2.52	2.36	4.88	[4] 26.99	18.1
Merchant bars	Large Bessemer billets	2.14	1.111	2.38	3.06	5.44	[5] 26.60	20.5

[1] Calculated from book cost by taking integrated costs for large Bessemer billets and allowing loss of 8 per cent.

[2] Calculated from book cost by taking integrated costs for Bessemer ingots and allowing loss of 15 per cent.

[3] Cost of producing slabs assumed to be same as for large Bessemer billets.

[4] Calculated from book cost by taking integrated costs for large Bessemer billets and allowing loss of 15 per cent.

[5] Calculated from book cost by taking integrated costs for large Bessemer billets and allowing loss of 10 per cent.

Each essential step in the calculation is clearly shown in the table, but as the table is somewhat complex it is desirable to give some further explanation of its contents and the way in which it should be used. For convenience of explanation, the columns have been numbered. Three items are necessary in order to arrive at the cumulative labor cost: (1) The labor cost per ton on the materials from which the product is made. This item is shown in column 1, but is limited in the case of "works labor cost" to the labor cost which has taken place within the blast furnace or steel works. (2) The amount of such materials required to produce a ton of the particular product, shown in column 2 of the table. (3) The labor cost per ton involved in the particular process under consideration, shown in column 4. With these facts the cumulative costs may easily be calculated.

During every process there is, of course, a certain amount of loss and waste which must be taken into account in calculating both the labor cost and the total cost of production. For example, in the production of Bessemer ingots from pig iron there is a customary loss of approximately 10 per cent, and 1.111 tons of pig iron must consequently be used to produce 1 ton of ingots. As there is a works labor cost of 77 cents per ton involved in the production of pig iron, there is a total labor cost of 86 cents in the production of the amount of pig iron necessary to produce 1 ton of ingots. To this must be added the item of 57 cents, which is the cost of the labor required to convert the necessary amount of pig iron into 1 ton of Bessemer ingots. This gives a cumulative works labor cost of $1.43, shown in column 5.

The cost of labor, however, is of no particular significance unless the relation which it bears to the total cost of production is known. The report of the Commissioner of Corporations is the source from which the information as to the cost of production shown in the tables is derived. The Commissioner of Corporations in his report gives for a large number of products both the "book cost" and the "integrated cost." The book cost represents the figure which is used by the manufacturers in their accounting and includes various profits which are charged from one department of the business to another. For example, in the case of ore-producing corporations the book cost includes profits which the ore-mining branch of the corporation charges to the blast-furnace department. These so-called "transfer profits" are, of course, largest in the case of the Steel Corporation, but they also exist and are of considerable importance in the case of the larger "independent companies." The "integrated cost" has, therefore, been calculated by the Bureau of Corporations in order to show the actual cost of production after the exclusion of all transfer profits. From this figure all items of profits charged by one subsidiary company to another have been excluded. This integrated cost of production, therefore, is the correct figure to be used as the basis for the calculations in the present discussion.

In the case of a few of the more highly finished products, as, for example, merchant bars, the report of the Commissioner of Corporations shows only the "book" cost of production. In the case of these more highly finished products, however, there are practically no transfer profits, and it is possible, therefore, to compute very nearly the proper integrated cost of production by taking the integrated cost on the preceding material and allowing the proper degree of loss. In the case of merchant bars, for example, the materials from which they are made are large Bessemer billets, of which approximately 1.111 tons are required for a ton of merchant bars. The integrated cost of producing a ton of Bessemer billets is $17.90, and it is possible, therefore, since no profit is ordinarily charged in the transfer of billets to the merchant-bar department, to calculate very closely the integrated cost for merchant bars.[1]

From the preceding table it will be seen that the cost of the labor connected with the production of pig iron amounts to only 6.4 per cent of the total cost of production. Even in the case of the most highly finished product, merchant bars, the cumulative labor cost within the plant amounts to only 20.5 per cent of the total cost of production. This item of the works cost is of the greatest significance because it includes all of the labor in the steel industry proper and consequently indicates the effect which an increase in the rate of wages will have upon the cost of production. For example, in the case of pig iron an increase of 10 per cent in the average rate of wages would not increase the cost of production 10 per cent, since the total labor cost amounts to only 6.4 per cent of the total cost of production. The actual increase in the total cost of production resulting from such an increase in wages would be only 0.64 of 1 per cent. Similarly, in the case of merchant bars an increase of 10 per cent in the rate of wages for all workmen employed in connection with blast furnaces, Bessemer converters, blooming and bar mills would increase the cost of production of merchant bars by only 2 per cent.

TOTAL LABOR COSTS.

In the preceding pages the discussion of labor costs has been limited to the labor performed inside the manufacturing plants. A number of the large companies, however, mine their ores, coal, and limestone and manufacture their own coke. In the case of such

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[1] The entire calculation is shown in the following example:

COST OF PRODUCTION OF ONE TON OF MERCHANT BARS.

Raw materials—1.111 tons large Bessemer billets, at $17.90 (integrated cost)	$19.89
Manufacturing costs other than for materials:	
Labor	3.06
Other operating	2.28
Additional costs (selling, depreciation, etc.)	1.37
Total cost per ton of merchant bars	26.60

companies an increase of wages in the manufacturing plants must generally be accompanied by an increase of wages in the mines, quarries, and coke plants. Therefore, in studying these companies, in order to ascertain the total effect upon the cost of production of increases in wages it is necessary to take into account the cost of the labor expended in mining raw materials and in making coke. The cost of this labor plus the "works labor cost" constitutes what is hereafter called "total labor cost." The total labor cost covers all labor expended from the mine to the finished product, except that of transportation. No account is taken of labor cost involved in transportation for, except in the case of the Steel Corporation, the transportation of materials is not performed by the steel companies, and the data could be secured only with great difficulty. Furthermore, the wages of the employees on the railroads are in large part under the control of labor unions and consequently do not follow the course of wages in the steel industry in the same way as in the case of the ore and coal mines.

The following table shows the "total labor cost" of the principal crude and finished products of the iron and steel industry. The form and principles upon which this table is constructed are the same which have already been explained in connection with "works labor costs."

CUMULATIVE TOTAL LABOR COSTS, FROM EXTRACTIVE PROCESSES TO FINISHED PRODUCT, EXCLUDING RAILROAD AND WATER TRANSPORTATION, 1902 TO 1906.

[Compiled from Report of the Commissioner of Corporations on the Steel Industry, Part II. Preliminary Report, January 22, 1912. Tons of 2,240 pounds are used, except for coke, 2,000 pounds.]

Product.	Materials.	1 Tons of raw material used per ton of product.	2 Labor cost per ton of raw material.	3 Total labor cost on amount of material used per ton of product (1×2).	4 Cost per ton of labor connected with production of product.	5 Cumulative labor cost per ton of product (3+4).	6 Total integrated cost of production per ton.	7 Per cent which cumulative total labor cost is of total integrated costs (5÷6).
Bessemer pig iron	Lake Superior ores	1.835	$0.45	$0.83 } $2.26	$0.77	$3.03	$12.10	25.0
	Beehive coke	1.155	1.13	1.31				
	Limestone	.500	.24	.12				
Bessemer billet ingots	Pig iron	1.111	3.03	3.37	.57	3.94	15.47	25.5
Large Bessemer billets	Bessemer billet ingots	1.111	3.94	4.38	.55	4.93	17.90	27.5
Wire rods	Large Bessemer billets	1.087	4.93	5.36	1.53	6.89	25.25	27.3
Structural shapes	Bessemer billet ingots	1.176	3.94	4.63	2.15	6.78	24.83	27.3
Bessemer rails	Bessemer rail ingots	1.176	3.94	4.63	1.16	5.79	18.80	30.8
Sheared plates	Slabs[1]	1.176	4.93	5.80	2.36	8.16	26.99	30.2
Merchant bars	Large Bessemer billets	1.111	4.93	5.48	3.06	8.54	26.60	32.1

[1] Cost of producing slabs assumed to be same as for large Bessemer billets.

It will be seen that the entire labor cost involved in the production of a ton of pig iron and all the materials therefor amounts to only $3.03, or 25 per cent of the total cost of production. Even in the case of merchant bars, the most highly finished product, the cumulative labor cost from the mines to the rolling mill (except transportation labor) amounts to only $8.54, or 32.1 per cent of the total cost of production. An increase of 10 per cent in the wages of all employees in the ordinary steel plant as well as in the mines and coke plants would make an increase of only 3.2 per cent in the total cost of production of the most highly finished products.

The question in which the public, however, is particularly interested is the relation of labor cost to the selling price and the consequent effect of increases in wages on the selling price of products. In order to bring this out clearly the following table has been prepared showing the relation of both "works labor cost" and "total labor cost" to the average selling price of the principal products of the industry. The "works labor cost," it should be remembered, includes only the labor employed in the iron and steel industry proper, while the "total labor cost" includes also the labor employed in the mines, coke plants, and quarries.

COMPARISON OF CUMULATIVE LABOR COSTS (BOTH WORKS COST AND TOTAL COST) WITH AVERAGE SELLING PRICE, 1902 TO 1906.

Product.	Works labor costs (from receipt of materials to finished product).			Total labor costs (from mines to finished product, excluding railroad and water transportation).		
	Labor cost per ton of product.[1]	Average selling price per ton of product.[2]	Per cent which labor cost is of selling price.	Labor cost per ton of product.[1]	Average selling price per ton of product.[2]	Per cent which labor cost is of selling price.
Bessemer pig iron	$0.77	$18.00	4.3	$3.03	$18.00	16.8
Bessemer billets	2.14	26.51	8.1	4.93	26.51	18.6
Merchant bars	5.44	34.76	15.7	8.54	34.76	24.6
Structural shapes	3.83	36.43	10.5	6.78	36.43	18.6
Bessemer rails	2.84	28.00	10.1	5.79	28.00	20.7
Steel plates	4.88	35.58	13.7	8.16	35.58	22.9

[1] Compiled from Report of Commissioner of Corporations on the Steel Industry, Part II. Preliminary Report, January 22, 1912.

[2] Compiled from Annual Statistical Reports of American Iron and Steel Association.

It will be seen from the table that the cost of labor directly connected with the production of pig iron amounts to 77 cents or 4.3 per cent of the average selling price per ton of Bessemer pig iron at Pittsburgh. Including with this the labor required in the mines and coke plants the total labor cost per ton of pig iron amounts to $3.03 or 16.8 per cent of the selling price. An increase of 10 per cent in the rate of wages at the blast furnaces would, therefore, mean an increase of 0.43 of 1 per cent in the price of pig iron. This is equivalent to an increase of 7.7 cents per ton. Even if the wages at the mines and coke plants were also increased 10 per cent this would cause an increase of only 1.68 per cent in the selling price of pig iron, or approximately 30 cents per ton. As the price of pig iron regularly fluctuates through a range of $1 or more during the course of the year, such an increase would hardly be noticeable. Even in the case of merchant bars, the total labor cost, including the labor at the mines, etc., amounts to only 24.6 per cent of the selling price, and an increase of 10 per cent in the rate of wages in the steel plants and also in the mines, etc., would increase the price of merchant bars only 2.46 per cent, or 86 cents per ton.

CHAPTER XII.

WORKING CONDITIONS AND EFFICIENCY AS AFFECTED BY HEAT.

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WORKING CONDITIONS AND EFFICIENCY AS AFFECTED BY HEAT.

INTRODUCTION.

This chapter and the two following chapters are a study of the physical conditions of work in the iron and steel industry and of the effect of such conditions on the efficiency of the workman. The purpose of the study is twofold: First, to present an accurate and, as far as possible, a graphic picture of the nature of the work and the physical surroundings, and, second, by reference to the past history of the industry, to discover what effect the development of the technical methods of production has had upon both the efficiency of the workmen and the physical conditions under which the work is done. The method of study is altogether comparative, because even if the exact facts relative to the efficiency of men and machines be known their significance can not be appreciated unless they are referred either to conditions in the past history of the same industry or to conditions existing at the same time in other comparable industries.

In such a study two salient facts emerge: First, that every successful attempt to improve the physical conditions under which the work of making steel is done has resulted in increased efficiency of the workmen, and, second, that almost without exception every genuine advance in the art of steel making has improved the physical conditions under which the men work. This statement, it should be noted, does not mean that every increase in production has bettered the working conditions, for in many cases a great output has been secured only by subjecting the workmen to the most exhausting and undesirable conditions. It does mean, however, that the technical advances in steel production have been of such a character that they have tended to eliminate or greatly minimize the most undesirable conditions under which the work was formerly done.

This result has not been at all a matter of chance, but has been the result of the soundest commercial motives. In order to secure men to perform the most severe and difficult work, it is necessary to pay very much higher than the ordinary wages, even though the work does not require a high degree of skill. Furthermore, since men can work only at low efficiency and for only a short time at exhausting labor or in debilitating surroundings, it is necessary to employ a very much larger force of men than would be required if the work were lighter or if it were done under conditions which could be borne without exhaustion throughout the whole working period. Consequently one of the most effective ways to decrease costs or to increase production is to eliminate from the work the elements which require this exhausting labor or to invent machines which will do the work. The efforts of the metallurgist and engineer, therefore, while primarily directed to lowering costs or to increasing production, have had the effect of improving the working conditions under which the labor in the steel industry is performed.

On the other hand, it frequently happens that the conditions which most seriously lower efficiency operate in such an indirect manner that they are not appreciated by the practical men in the industry. This was to a considerable extent true as regards the question of accidents. As a commercial proposition few practical men realized the great, though somewhat indirect, bearing which the high accident rate in certain branches of the industry had on the efficiency of the workmen. The elimination of these hazardous conditions was approached principally from the humanitarian standpoint. Nevertheless, as shown in Volume IV of this series, great advances in production have resulted directly from the elimination of conditions which were productive of accidents. Similarly, in other directions, improvements which have been introduced simply to relieve the workmen from intolerable conditions of heat or exposure to fumes and smoke have been found to have the most direct bearing on the productive power of the workmen.

From the standpoint of the manufacturer, labor efficiency is measured by the amount of product secured from a given labor unit in a given period of time. Accepting this point of view, an anlysis of efficiency shows it to be the resultant of three factors: (1) "Skill," including both the dexterity of the workman and whatever technical ability and training he may possess; (2) the "intensity" with which the necessary skill can be applied during a definite time unit; (3) "duration," i. e., the total number of hours in the working day during which efficient work can be maintained.

It will be noted that in the above analysis no account has been taken of the gain in social efficiency through the lengthening of the trade life or of the period of industrial efficiency of the workmen. While this factor is of the greatest importance socially and of some consequence to the manufacturer himself, it is best that it should be considered separately, as it is a question of the greatest complexity and in a way is simply a resultant of the three factors named above. Furthermore, the significance of this factor to the manufacturer is so remote that it is generally ignored, or if considered is entirely subordinated to other elements.[1]

A brief extension of the analysis will indicate the particular conditions which must be studied in connection with each of these factors. The first factor, namely, that of skill, may be modified in two ways to promote efficiency—by simplifying the processes so that a shorter period is required to gain the necessary skill or so that a lower degree of natural ability is demanded, or by so increasing the permanence of the labor force that there is less loss of time and energy in the training of new men.

In considering the second and third factors—intensity and duration—it is necessary to study (1) the improvements in physical conditions which make it possible for a man to put his entire undivided energy into the task before him during any given time period; (2) the changes in the nature of the work which result in the elimination of hard and exhausting manual labor and make it possible to cut down the periods of rest necessary to allow the men to recuperate; (3) the changes in equipment, which have tended to eliminate the long periods of idleness, which were not necessary for recuperation, but were the result solely of the fact that one step in the process had greater productive capacity than the others; (4) the effect of long hours and of night work in tending to lower the efficiency of the workman by making him more easily tired and unable to concentrate his full energy for even a short period on his assigned task.

The subject of the physical conditions of work and the related subject of the efficiency of workmen involve questions of considerable complexity. Many factors combine to produce a given set of conditions. For convenience of discussion, however, four factors, or rather groups of factors, may be distinguished for separate study. These four factors are as follows:

1. The temperature conditions of the several departments and occupations.
2. The speed and severity of the work.
3. The conditions of employment, i. e., regularity of employment, wages, hours of labor, etc.
4. The hazards of the industry.

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[1] The general attitude of the manufacturer and engineer toward this question has been clearly stated by an eminent American metallurgist, as follows:

> Proof that the pace was such as to shorten his years of physical vigor, and thus lessen the amount which he can accomplish in his lifetime, would, I apprehend, count for little with directors and managers. * * * As humanitarians we might regret such diminution of the gross sum of the workman's working power. As managers, hired by others to make money for them by metallurgy, we would be no more justified in diminishing our employer's profits by allotting to the workman less work than he willingly and knowingly, without deceit or pressure on our part, sought or accepted than we would in substituting machine for hand puddling, knowing the former to be less profitable, or in shortening the puddlers' shift to four hours. The workman is a free agent. (H. M. Howe, Journal, British Iron and Steel Institute, 1890, p. 118.)

The first three of these four factors form the subject matter of this chapter and of the two succeeding chapters. As the importance of the fourth of the enumerated factors—hazards—is thoroughly analyzed in Volume IV, Accidents and Accident Prevention, it is unnecessary in this volume to discuss this factor further than to enumerate the principal effects of hazardous occupations and surroundings on the efficiency of workmen. The effects are, in brief, as follows: (1) The existence of hazards necessarily divides the workman's attention and makes it impossible for him to apply himself to his work with the full degree of intensity which is necessary in order to secure efficiency; (2) the constant interruption of the operation of machines and processes by accidents, whether or not any serious injury is done, necessarily lowers the efficiency of the entire department in which the accidents occur; (3) the loss of skill and dexterity involved in periodic absences from work due to minor accidents greatly lowers the efficiency of the entire working force; and (4) the loss through death or disability of men who have acquired skill and experience, sometimes through long periods of training in the industry, must necessarily greatly lower the efficiency of the entire working force.

TEMPERATURE CONDITIONS IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS.

CHARACTER OF RECORDS OBTAINED.

The question of the exposure of employees to unusual heat has two main aspects: First, the general conditions of temperature in a department as a whole; second, and perhaps more important, the exposure of employees in particular occupations to extremely high temperatures during a short period, or to considerable heat during the greater part of the working day. In order to ascertain just what the conditions were in the different departments and in connection with the more important occupations, a large number of very careful temperature readings were made in several different plants by agents of the Bureau. The plants selected represent in a general way the varying conditions throughout the industry. The attempt was made to secure at least two temperature records for each position and to have them made by different agents of the Bureau and in different plants, so as to eliminate as far as possible the personal equation and the effect of local conditions. Great difficulties were encountered, however, in making the tests and in securing satisfactory records. Wherever possible the readings were made personally by agents of the Bureau, who were careful to occupy exactly the same position and be under exactly the same conditions to which the workman would be exposed. In a few cases, however, records could be obtained only by attaching the thermometer to the workman and securing a reading immediately after he came out of the position. In some cases, moreover, the workman was in the position for such a short time that even the very sensitive thermometer used did not have time to register the full heat. In such cases two alternative methods were used: First, the thermometer was attached to a stick and held in place until a reading could be obtained, or, second, the mercury was first raised to some 20° or 30° less than what experience indicated the final temperature would probably be, thus making it possible for the observer to stand the heat long enough to allow a satisfactory record to be made. No record was ever considered satisfactory unless the exposure lasted a sufficient time for the column of mercury to become absolutely stationary. In some cases, particularly in the Bessemer department, the high temperature was due to a sudden burst of flame or to some similar condition, and lasted so short a time that the thermometer could not register the full temperature. It is believed that the records presented in the following pages are thoroughly conservative. The records of the plant for which the largest number of observations was made were submitted to its superintendent, a practical steel man who had given considerable attention to the temperature of working positions. They were pronounced by him to be conservative and to fall below the expectations based upon his own experience. In considering these records it should be noted that in a large number of cases the heat arises directly from large masses of molten material, and consequently is much more severe in its effects upon the workmen than heat from a nonradiant source.

The presence of extreme heat in connection with any operation may in general be accepted as indicating inefficiency of operation, not only because such heat lowers the efficiency of the individual workman, but also because radiated heat represents heat that is doing no useful work or lost heat which must be restored by reheating the metal before the next operation. Many of the most striking advances in the methods of production have resulted from attention to this factor. A notable example of this is to be seen in the system of casting steel in the Bessemer and open-hearth departments in molds mounted on small cars which are drawn one by one in front of the ladle from which the steel is poured. The great gain effected by the introduction of this system of casting and its effect on the working conditions of the man has been commented upon by a metallurgist as follows:[1]

> The car-casting system deserves description chiefly because it shows how, when the scale of operations is as enormous as it is in

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[1] H. M. Howe, in Encyclopædia Britannica, 10th ed.; article, "Iron and Steel."

the Bessemer process, even a slight modification and a slight heat saving may be of great economic importance * * *. Here (i. e., in pit casting) each mold and each ingot was handled as a separate unit twice, instead of only once, as in the car-casting system; the ingots radiated away great quantities of heat in passing naked from the converting mill to the soaking furnaces, and the heat which they and the molds radiated while in the converting mill was not only wasted, but made this mill, open-doored as it was, so intolerably hot that the cost of labor there was materially increased.

Even more important in their effect on heat conditions than the introduction of new methods and machines have been the great changes in the fundamental processes of producing steel. In the puddling mills practically every man connected with the operation performs very heavy manual labor and is at the same time exposed to very high temperature. In the Bessemer process, which to a large extent superseded puddling, only a small number of men are exposed to abnormal heat conditions, while the product per man is so greatly increased that the number of men required to produce a given tonnage is less than one-tenth as great as the number which would have been required if the same amount of product were produced by puddling. Similarly, the open-hearth process marked a great advance in heat conditions over the Bessemer department and an almost equally great reduction in the number of men required to be exposed to high temperatures.

In the mechanical working of steel the displacement of forging by rolling has greatly improved conditions, which can be analyzed as follows: First, the increase in the amount of product per man requires the exposure of a smaller number of men to the heat in order to produce a given tonnage; second, the temperature is less severe and the men are not required to be in contact with the hot metal for so long a time; third, the forging process was so slow that frequent reheating of the material was necessary before it was finally finished. This made it necessary to use such a large number of furnaces that frequently they entirely surrounded the forging press or hammer, and cut off the workmen from the fresh air.

Other notable instances of the improvement of working conditions in this respect by the use of new methods and machines are to be seen in the introduction of mechanically filled blast furnaces, in the use of machines for charging materials in open-hearth furnaces and reheating furnaces, in the more extensive use of water-cooled doors for furnaces, and in the elimination of hand work in the rolling mills.

In the discussion of the temperature conditions in each of the departments the principal modifications in machines and method of operation which have affected the conditions under which the work is done will be discussed in full.

BLAST-FURNACE DEPARTMENT.

In no department, perhaps, has there been so great a change as regards the heat to which the workmen are exposed as in connection with the blast furnaces. With the old-style furnace, filled by hand and using sand beds for casting, three groups of men are exposed to conditions of extreme heat—the top fillers, the casting crew, and the iron breakers and carriers. In the modern furnace only one of these groups, the casting crew, remains, and the temperature conditions to which they are subjected have been greatly relieved by the introduction of improved and more efficient methods of work. However, a number of furnaces still remain which are filled by hand, and it is proper that some consideration should be given to the conditions to which the men performing this work are exposed.

In the tables below are given for two separate blast furnaces the temperatures for practically every important position in connection with the operation of the furnaces. It will be noted that the data presented in these tables show not only the temperature at the particular position connected with the work, but also the temperature outside the mill at the same time.

BLAST FURNACES: TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

PLANT A.

Workmen exposed continuously or nearly continuously during working hours.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	[1] 75 [2] 81	76	On top of stack, midway between hoist and hopper.	Top fillers work in each of the positions shown; they go into each of these positions consecutively in getting buggies from hoist and distributing charge in hopper.	Top fillers...	2 or 3	......	......	[3] 12	......
		80	On top of stack, near hopper, 4 feet from bleeder, on windward side of furnace.							
		78	On top of stack, opposite side of hopper from hoist.							
		79	On top of stack, near hopper, 4 feet from bleeder, on leeward side of furnace.							
2	[1] 80	102	Iron plates of furnace top, on which men walk.	Charge furnace						

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[1] At top of hoist.

[2] On the ground.

[3] Less varying rest times, which the men arrange among themselves, 1 man doing double work while the other rests.

BLAST FURNACES: TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Concluded.

PLANT A—Concluded.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
3	84	[1]95	10 feet from furnace, midway between tap hole and cinder notch.	....	Keeper...... Helpers......	1 2	....	....	....	....
4	84	[1]88	Beside far end of iron runner.							
5	84	96	5 feet from tap hole...	Drilling tap hole open.	Keeper...... Helpers......	1 2	2½ 2½	3 3	....	7½ 7½
6	84	112	Beside iron runner cast, 12 feet from open tap hole.	Keep iron and cinder running properly.	First helper. Helpers and laborers.	1 5	7 3	3 3	....	21 9
7	84	140	3 feet from keeper's position at mud gun.	Closing tap hole with clay.	Keeper...... Helper...... Clay man...	1 1 1	4 4 4	3 3 3	....	12 12 12
8	84	128	Near iron and slag runners after cast.	Clean floor after cast.	Helpers..... Laborers....	2 2	60 60	3 3	3 3	....
9	84	106	Beside cinder run, 8 feet from cinder notch.	Tap cinder....	Keeper......	1	2	7	......	14

PLANT B.

Workmen exposed continuously or nearly continuously during working hours.

Number of reading.	Outside in shade.	At position specified.	Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Hrs.	Minutes.
1	[2]76	78 97 118 127	Behind iron shield from which bell is lowered, midway between hoist and hopper. On top of stack, opposite side of hopper from hoist. On top of stack, near hopper; no bleeder on this side of furnace. On top of stack, between bleeder and hopper, and on same side as row of stoves.	Top fillers work in each of the positions shown; they go into each of these positions consecutively in getting buggies from hoist and distributing charge in hopper.	Top fillers...	3	......	......	[3]12	......

PLANT C.

Workmen exposed continuously during periods specified.

Number of reading.	Outside in shade.	At position specified.	Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Hrs.	Minutes.
1	96	147	Three feet from iron runner and 12 feet from tap hole.	Breaks up heavy cinder, to keep it flowing.	First helper.	1	4	3	......	12
2	96	[4]114	At side of cast house, halfway down length of cast house.	....	Casting crew	3	30	3	1	30
3	96	144	At mud gun.........	Stopping up tap hole.	Keeper, 2d helper, and 1 cinder man.	3	1	3	......	3

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[1] General temperature of furnace floor before cast.

[2] At bottom of furnace.

[3] Less varying rest times, which the men arrange among themselves.

[4] General temperature during cast.

TOP FILLERS.

In an advertising booklet issued by one of the steel companies during recent years the following comment on the work of the top fillers appears:

> In the olden days men inured to incredible heat had to dump these charges into the furnace top, but nowadays mechanical devices step in to relieve men of undue exposure in every step in the steel industry.

While this properly describes the usual conditions existing at the top of the blast furnaces, it will be noted that the temperature in Plant A at the top of the furnace (76° to 80°) does not represent unusual heat; it was, in fact, somewhat below the normal outside temperature at the same time. This result was so unexpected that two sets of readings were made for this particular furnace on two different days, on the 4th of June and on the 9th of June. The reading shown in the table was made about an hour before the heat was tapped from the furnace, when the hearth was practically full of metal and the heat was probably at least as high as under normal operating conditions. The unusually low temperature shown by this furnace is due to the combination of several factors. In the first place, the furnace is situated near a river and its elevation insures an almost continuous breeze at all times. Again, the top of the furnace is surrounded only by a railing which permits the breeze to blow directly across the top of the furnace and carry away the heat as rapidly as it is radiated. Furthermore, the men at this furnace are provided with a hose, by means of which they can wet the plates which form the top of the furnace whenever the heat becomes excessive. It will be noted that the temperature of the iron plates upon which the men walk were at the time of taking these readings (No. 2) 102°.

The conditions to which the top fillers were exposed in Plant B were entirely different. Here the temperature (ranging from 78° to 127°) was almost unbearably high, and the men had no relief except by going back into the house which is built around the elevator shaft, or by going out for a few minutes on the runway which connects the blast furnace stack with the stoves. This furnace differs from the furnace in Plant A in that the top of the stack is completely surrounded by a solid wall of plates, about 7 feet in height, which completely prevents whatever breeze may blow from carrying away the dead heat radiated by the furnace. There is no provision in this furnace for cooling off the plates, and, to add to the discomfort of the men, the " bleeder " or pipe through which the waste gases escape is very short, so that the hot gases and cinders are blown down on the men working at the top of the furnace.

Neither of these cases, however, represent the extreme conditions to which top fillers are subject. These conditions of extreme heat are to be found when there is a bad leak, either in the furnace top or around the bell, which allows the hot gases from the interior to escape, and particularly when there is a cross wind which blows these gases back into the elevator shaft, where the top fillers must go to get the buggies of materials. Whenever such a situation exists it is possible for the men to work in the heat and poisonous fumes for only a few minutes at a time, and sometimes as many as 16 men are sent to the top of the furnace to do the work which would normally be done by only four men. Finally, the top fillers work under the constant menace of being severely burned by a great rush of flame through the furnace top, if there is a bad slip or an explosion, and are exposed to the possibility of being killed by the force of an explosion. These explosions are sometimes of such power that the entire top of the furnace is lifted off, and in such cases there is absolutely no escape for the top fillers.

CASTING CREW.

The casting crews of blast furnaces are not subject to constant high temperature but rather to extremely high temperatures for periods of varying lengths. As a general thing, the construction of the "cast house" is so open that whatever heat is radiated from the furnace is quickly carried away by the breeze and, consequently, the temperature is only a little higher than the outside temperature. It will be noted from the records of Plant A that when the outside temperature was 84° (Nos. 3 and 4) the temperature on the cast-house floor, with no metal running, ranged from 88° at the extreme end of the iron runner to 95° at a distance of 10 feet from the furnace. The casting crew, however, is exposed to very extreme temperatures for comparatively long periods, two or three times a turn, according to the number of times that the metal is tapped from the furnace.

The degree of heat radiated by 100 tons of metal flowing from a blast furnace can hardly be realized unless one has actually been exposed to it at close range. While the metal is flowing out of the furnace it is necessary for the keeper and his helpers to change the position of the gates which regulate the flow of metal into the different runners and to break up the masses of slag and cinder which form and tend to impede the flow of the iron. While this work is being done the men are exposed to heat which, as accurately as measurements could be made, was found to range from 110° to about 150°. The workmen usually plan so as to be exposed to this extreme heat for as short a time as possible and they work very rapidly while they are so exposed. After the metal has been completely drained from the furnace the floor of the cast house has to be cleaned up. This occupies from half an hour to a full hour, and during the entire time the keeper's helpers are exposed to extremely high temperatures, ranging from 110° to 130°, according to local conditions. It must be understood, however, that even during this period they frequently go to cool parts of the furnace floor to get a breath of fresh air, for an hour's hard work in a temperature of 128°, with no relief, would exhaust any man, however accustomed to such conditions. The men are also exposed to an extremely high temperature when the tap hole, through which the metal flows, is being plugged up. This exposure is not nearly so severe at the present time as formerly, for the introduction of the steam mud gun has greatly shortened the process of closing up the hole and the operation does not require the presence of so many men. Also, while the metal is being run the men work in a much lower temperature than they formerly did, owing to the use of various methods of operating from a distance the gates by which the flow of metal is regulated. The most common method of accomplishing this is through the use of long levers, by which the gates can be raised and lowered. In cleaning up the floor after the metal has been run the men are greatly relieved in the modern furnace by the use of cranes to remove the heavier and consequently hotter pieces of cinder.

IRON BREAKERS AND CARRIERS.

The most severe conditions of heat, however, to which any of the blast-furnace men are subjected are those which the iron breakers and carriers must endure wherever the old method of casting the iron in sand beds is in use. Furthermore, the conditions to which these men are subjected are rendered all the worse by the fact that the exposure is continuous, since it is necessary to work very rapidly at the most strenuous manual labor in order to get all the iron broken up before it is entirely cooled. No satisfactory temperature records covering this operation could be secured, but it is agreed by all furnace men that this is the hottest job around the furnace. In this connection it is possible to quote from the written opinion of a mill superintendent with regard to this occupation, as follows:

> An exceedingly hard and laborious job. In addition to the heat, they were working constantly in a cloud of moist vapor of high temperature, which of itself was decidedly debilitating.

The introduction of casting machines and the increased use of the method of carrying the metal in ladles directly from the blast furnaces to the Bessemer and open-hearth departments has largely done away with this work, which remains only in old furnaces or where the iron is being made for special foundry use.

STOVE CLEANING, BOILER ROOMS, AND SLAG DISPOSAL.

In addition to these positions around the furnace there are other occupations in which exposure to extreme heat is required which should be commented upon. The first of these is that of stove cleaning. It is frequently necessary for the workmen to go into the stove before it has entirely cooled and remove the accumulated dust and cinder. This work is very much harder wherever the cleaning is done from the bottom of the stove by thrusting brushes and scrapers up through the flues from below. A good many years ago a method was devised for cleaning the stoves by letting brushes and scrapers down through openings at the top of the stove. This method does not require that a man shall go inside the stove. A number of plants, however, still exist in which the arrangements necessary to allow this method to be used have not been made, and the stove cleaners in such plants are consequently exposed not only to extreme heat but also to great danger from the falling of loosened brick and of heavy pieces of cinder which may have accumulated in the flues.

In many of the boiler rooms conditions are extremely bad, owing to crowded conditions and improperly constructed buildings. These conditions, of course, are merely the conditions to which stokers everywhere are subjected, and do not require particular comment.

Finally, the whole matter of the disposal of slag presents certain conditions of exposure of employees to high temperatures. These conditions vary greatly with the method used. The method which was used at all plants many years ago consisted in allowing the slag to accumulate in pits or on a "bank" and then sending men in with crowbars and sledges to break it up and haul it away. This work was described by a superintendent as follows:

> It was their duty to quench the cinder, break it up with the aid of bars and sledges, and load it on cars by hand with a fork—a very hot and laborious job, constantly at work in a cloud of steam and exposed to weather conditions in the open at all times of the year.

In almost all plants the use of ladles and special slag cars has done away with these conditions. However, in dumping the slag from the ladles the men are for a short time exposed to very high temperatures. In dumping the slag one man, or more than one, usually operates a winch by which the ladle is turned down, while another man with a long bar breaks the slag loose from the inside of the ladle and helps to make it flow more easily. In addition to heat, the men are exposed to great volumes of smoke while doing this work, and to protect themselves they usually put bags over their heads with small openings cut for their eyes. The use of air compressed by the locomotives to operate the mechanism by which the ladles are tilted has greatly assisted in removing the worst of these conditions, but the work on the slag dump is still characterized by the exposure of the men to considerable heat during a good part of their working day.

A more recent method of slag disposal has done away entirely with the exposure of men to such high temperatures, although it has its own disadvantages. This method consists in granulating the slag as it flows from the furnace by flooding it with water. So much steam, however, is generated in this way that if the wind is not in the right direction it completely envelops the blast furnace casting floor and greatly interferes with the work of the men. This difficulty has been obviated to a large degree by extending the wall of the granulating pit several feet higher than the level of the blast furnace floor, leaving only an opening through which the slag can enter the pit, so that the steam tends to pass above the heads of the men.

BESSEMER DEPARTMENT.

The temperature conditions in the Bessemer department are of great importance not only because of the extreme heat to which the workmen are at times subjected, but also because the nature of the process renders it so spectacular that the conditions impress the casual observer as being perhaps worse than they actually are. Furthermore, the great increases in the productive capacity of Bessemer converters have been primarily due to the conservation of heat.

The following figures show in a striking way the rapid increase in the productive capacity of Bessemer converters within 25 years. The increase would be even more striking if an earlier year were taken as the base (in 1870 the maximum weekly production of a pair of converters was only 254 tons), but the Bessemer process had not passed the experimental stage much before 1880. By 1880, however, the process was fully developed in all essential features and strenuous efforts to produce record outputs were being made.

MAXIMUM PRODUCTION OF INGOTS BY A PAIR OF AMERICAN CONVERTERS.[1]

Year.	Gross tons per week.	Relative production (1880—100).
1880	3,433	100
1889	8,549	249
1899	11,233	327
1903	15,704	457

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[1] Henry M. Howe, in Encyclopædia Britannica, 10th ed.; article, "Iron and Steel."

This increase has been achieved by attention to the conservation of heat in two parts of the process: (1) In connection with the molten metal preparatory to its use in the converter; (2) in reducing the loss of heat after the metal has been cast. When the Bessemer process was first introduced all the metal used was cupola iron; that is, pig iron remelted in cupolas, of which a large number were necessary in order to provide sufficient material for the converters. The first step in the conservation of heat consisted in eliminating the remelting of a part of the iron by bringing it in ladles direct from the blast furnaces while it was still molten. Only a small amount of the direct metal could be used at first, however, because there was such a wide variation in the character of the iron from the blast furnaces that it had to be "corrected" by the addition of large quantities of cupola iron. Furthermore, any delay in the Bessemer process meant the loss of several ladlefuls of iron, as the iron would cool so much in a short time that it could not be used without casting and remelting in cupolas. The pig-casting machine had not been perfected at that time, and it was difficult to cast the metal, consequently the absolute losses from this cause nearly offset the advantages secured by using "direct metal." The next step in advance consisted in the introduction of reservoirs, the large "mixers" which have already been described. These made it possible to keep the iron for long periods in a molten condition, and by mixing the iron from different casts and different furnaces to secure a fairly uniform quality of iron, which could be "corrected" in any case by the addition of only a small amount of cupola iron.

The improvements in handling the ingots after they are cast has consisted primarily in substituting "car casting" for "pit casting," as has been explained above, and in the perfection of the devices for handling the ingots and the waste metal and slag. The car-casting method made it possible to isolate from the Bessemer building the operation of stripping the ingots, thus removing one of the greatest sources of heat and danger from this department.

In the table below is shown the actual temperatures existing in connection with the most important operations at one plant. It may be noted that these temperatures were taken on different days, between which there was a marked difference in the outside temperature.

BESSEMER CONVERTING: TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
Workmen exposed continuously or nearly continuously during working hours.										
1	81	117	Cupola charging floor, midway between hoist and charging door; represents mean temperature in which cupola charger and hoistman work.	Pushing buggies from hoist to cupola and dumping same in cupola.	Cupola charger.	1	......	......	9	......
					Cupola hoistman.	1	......	......	9	......
	81	104	Platform outside top of cupola house.	Rest here at irregular intervals.	Cupola charger.	1	......	......	3	......
					Cupola hoistman.	1	......	......	3	......
2	90	107	Blower's platform....	Operating levers controlling vessels and ladles.	Blower......	1	......	......	[1] 12	......
					First regulator.	1	......	......	[1] 12	......
					Second regulators.	2	......	......	[1] 12	......
3	[2] 91	[2] 120	Beside steel pourer on casting platform.	Pouring steel from ladle into molds.	Steel pourer.	1	......	......	8	......
	[2] 80	[2] 100	Practically continuous exposure, except during long delays eight-hour day.		Stopper setter.	1	......	......	8	......
					Helper......	1	......	......	8	......
4	80	102	Vessel scrapping floor at scrap hoist.	Represent three heat zones in which scrappers work: *a*, where materials are brought up; *b*, general temperature of floor; *c*, actual heat to which exposed during short time of scrapping.	Vessel scrappers.	3	......	......	(3)	......
		110	Vessel scrapping floor at scrapping chutes, when not scrapping.							
		126	Vessel scrapping floor at scrapping chutes, when scrapping.							
Workmen exposed continuously during periods specified.										
5	90	125	Three feet from cupola tap hole.	Tapping iron from cupola into iron ladle.	Cupola foreman.	1	1	50	......	50
					Cupola tapper.	1	1	50	......	50
6	91	130	Casting platform; men spell each other.	Capping and uncapping molds.	Mold cappers.	2	15	16	[1] 4	......
Workmen exposed momentarily several times during periods specified.										
7	80	120	On vessel charging floor near mouth of vessel.	Shoveling ferro-manganese into ladle.	Manganese man.	1	½	135	1	5

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[1] Less irregular delays of some duration, which, however, are few in number.

[2] Temperatures taken on different days.

[3] Vessel scrappers work in these three heat zones from 9 to 12 hours per day, depending on amount of delay in operation. For each vessel there are from 40 to 50 heats per turn, so that each scrapper is exposed to the highest temperature about 45 times for about half a minute each time. His relief is slight, for the lowest temperature in which he works on an ordinary summer day is over 100 degrees.

In explanation of the figures given in the above table, and also in order to make somewhat clearer the remarks on the specific occupations which follow, it should be explained that there are three main sources of heat in the Bessemer department: First, the cupolas and mixers; second, the converters; and third, the molten metal in the molds. The heat of the department as a whole and of each particular position as well depends on the relative location of these three sources of heat. It may be further explained that there are six principal working positions occupied by the men employed in this department—cupola-charging floor, cupola-tapping floor, vessel floor, casting pit, pouring platform, and the pulpit or blower's platform.

CUPOLA MEN.

Their first working position is the cupola-charging floor, upon which the men who handle the raw materials for the cupolas work. When the outside temperature was 81° the temperature of the charging floor was 117°, to which temperature the men were subjected during the whole of their 12-hour turn, except for the short periods, totaling approximately three hours, in which they were free to rest. While resting they were still in a temperature of 104°.

The second working position is the cupola-tapping floor, where four men worked on each turn. The temperature on this floor, with an outside temperature of 90°, varied from approximately 105° to 125° during the short time in which the iron was being tapped from the cupola.

VESSEL MEN, ETC.

The third important working position is the vessel floor, which is practically on a level with the center of the converter. From this floor the iron is poured into the converters and on this floor also the vessel men and manganese men, and in some plants the vessel scrapper, perform all or part of their duties. In some plants, however, the vessel scrapper does not work from this floor, but from one on a slightly higher level, as in the case of the particular plant for which the temperatures have been given above. This floor is the hottest part of a modern Bessemer building. Here there is the heat not only from the converters themselves but also from the iron ladles, from the molds and steel ladles, and from whatever metal has been spilled in the pit. Unfortunately, no readings could be secured to show the extremes of temperature for this floor. It seems safe, however, to say that with an outside temperature of 80° the temperature on this floor would never go below 100°, except in the case of some extraordinary breakdown or delay, while for short intervals the heat is so great that is is impossible to secure satisfactory readings. These exposures are, fortunately, of short duration, but the heat is so intense that to one not thoroughly accustomed to such conditions it is a source not only of discomfort but of actual pain.

PITMEN.

The fourth important working position is the casting pit. This was formerly the worst position in the Bessemer department and perhaps in the whole industry, but under the present method of casting ingots on cars the work has been relieved of much of its former severity. Under the old conditions the pit was filled with a great number of molds, which were full of molten steel slowly cooling and which were allowed to remain in the pit until the outside surface was thoroughly cooled. Frequently under such conditions the pit would contain as many as 25 molds filled with hot steel, and the heat radiated from such a great mass of molten metal rendered it almost impossible for the men to do any work at all. The stripping of the ingots was also done in the pit. This added not only to the heat radiated but also rendered the work of the pitmen, whose duties required them to clean up any steel or slag spilled in the pit as soon as possible before it had thoroughly cooled, exceedingly dangerous as well as almost unbearable. There is no Bessemer department in the country at the present time in which such conditions exist. The modern method of casting consists, as has already been described, in pouring the metal into molds mounted on small metal trucks, which are pulled out of the way as rapidly as they are filled. The result is that at no time is there a great number of molds containing hot metal in the building and those that do remain are usually pushed down toward one end of the building in which practically none of the men work.

LADLE MEN AND PLATFORM MEN.

The fifth position of importance is the pouring platform, which is usually situated alongside the casting pit directly opposite the vessels. Above the pouring platform is usually another platform known as the "pulpit," or blower's platform, which is the sixth important working position in the Bessemer department. Both of these platforms are subject to the general heat radiated from the vessels and from the pit. In addition, if the converters are so placed that when they are turned down to receive the molten iron the mouth of the converter is directed toward the casting platform, all the men on these platforms are subject to the heat and smoke which are blown out of the converter mouth as soon as the iron is poured in. Where only two converters are used it is possible to place them parallel with these platforms, so that none of the men are subjected to the direct heat from the vessels while the metal is being blown. All of the two-vessel plants in this country are arranged in this way, but this method has many disadvantages of its own, and it is possible only where two vessels are used. The men on the casting platform, in addition to the heat from the converters, are, of course, subject to the very great heat from the steel ladle and from the molten metal as it is poured into the molds. The heat on this platform varies from about 110° to something over 120° when the outside temperature is 90°, but the men are relieved from this extreme heat by the short delays which occur from time to time and by their opportunity to go out into the open air and rest and refresh themselves when the work is not pressing. In at least one plant also the men on the casting platform are greatly relieved by the use of forced-air pipes, which not only blow cool air upon them while at work but also serve to some extent to drive back the waves of heat from the vessels and from the ingot molds.

OPEN-HEARTH DEPARTMENT.

The heat conditions connected with open-hearth steel manufacture require more extended discussion than the other departments for three reasons: (1) In the other departments most of the workmen have fixed positions and are subject to virtually uniform heat conditions during the entire turn, but in the open-hearth department most of the men during the cycle of operations connected with producing a "heat" perform widely differing functions and work under varying heat conditions to a greater extent than in any other department. (2) The conditions of heat in different plants vary greatly according to the character of the building in which the furnaces are housed, the size and construction of the furnaces, the method of pouring and handling the ingots, and in general according to the care and attention that has been given to securing efficient and economical operation of the department. (3) In the open-hearth department particularly modern methods of construction and operation have relieved the work of the worst features of exposure to extreme heat, besides eliminating much of the most strenuous and exhausting physical labor.

One important source of heat in the open-hearth department is the "mixer." This is a huge receptacle of iron plates lined with fire brick, in which the molten iron for charging the furnaces is mixed and kept at a proper temperature. A mixer is usually designed to hold 200 or more tons of iron, and in the case of very large departments more than one mixer is used, so that the total amount of molten iron radiating heat is from 200 to more than 1,000 tons. The total amount of heat given off by so large an amount of iron is, of course, very great, but its effect on working conditions is greatly lessened by the fact that only a few men work in its immediate vicinity, and also by the fact that the greater part of the heat is radiated directly upward through the open top of the mixer and carried away by the ascending current of air through the openings in the roof. If, however, there is a breeze blowing across the mixer toward the charging floor the hot air is blown down upon the men and greatly affects their working conditions. In one open-hearth department a difference of 12 degrees was found to exist in the temperature of the charging floor, according to whether or not the breeze blew across the mixer. A considerable factor in the effect of the mixer on the general temperature is its position with reference to the level of the charging floor. If the open top of the mixer is on a level with or below the level of the charging floor, so that the column of heat ascending from it is diffused over the charging floor, the general temperature of the department is greatly affected, whereas, if it is considerably above this level, as is the case in the majority of open-hearth departments, a great part of the heat passes out of the building without being diffused. In the best-arranged establishments the mixers are placed in separate buildings, so that the heat from this source does not at all affect the men working around the furnaces.

The second and chief source of heat is the open-hearth furnace itself. In the typical open-hearth department there are from 6 to 20 furnaces, containing from 40 to 75 tons of metal each, arranged in a long row down the center of the building. In some of the older open-hearth plants there are double rows of furnaces placed back to back with an intermediate space of from 50 to 100 feet, which is used as a casting pit for both rows of furnaces. Such an arrangement creates conditions of extreme heat, but, fortunately, is not very frequent.[1]

The general effect of these great quantities of molten metal upon the temperature of the casting floor is by no means so great as one would suppose. On an ordinarily calm day the greater part of the heat from the furnaces is carried out of the building by an ascending column of air, which passes out through the special ventilator openings under the crown of the roof. In a well-constructed plant the heat from this source (the furnaces) when all furnace doors are closed and no "heats" are being tapped does not raise the general temperature of the building more than 3 degrees above the outside temperature. In a modern furnace, with water-cooled front and water-cooled doors, the greater part of the heat radiated from the hearth of the furnace is cut off, except when the doors are raised;

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[1] This arrangement is made the subject of special comment on p. 315.

but in the older furnaces, with iron or fire-brick doors, the radiated heat is so great that it is uncomfortable to stand within 20 feet of the front of the furnaces for many minutes at a time. When the doors are opened for charging or working the metal or repairing the hearth the heat from the white-hot interior of the furnace is thrown out to such a degree that it can be sensibly felt 30 feet away.

As will be seen from the records of actual readings, on page 313, the men in testing and working the heat and in repairing the furnaces are exposed to this terrific heat of upward of 150°. This exposure lasts but a short time, it is true, but the heat is exhausting even under the best of conditions. The best conception of the conditions during this work is given by the following notes of one of the agents of the Bureau:

> *Heat conditions and amount of work done in making bottom.*—Repairing walls and making bottom on furnace No. 23. Began work at south end at 2 p. m. Work as follows: Four men pass in regular order to dolomite pile 12 feet from furnace, get shovelful of dolomite (20 pounds), walk to furnace door, pause to see where material is needed, throw in shovelful of dolomite, walk back to pile. Work regularly, but without hurry; each man averages 4 shovelfuls in 3 minutes. Exposed to extremely high temperature constantly. Gunny sacks containing magnesite, 12 to 14 feet from furnace, smoking constantly. One caught fire and blazed up. Men were in this zone during entire time they were at work. Finished at south end 2.09 p. m. Rested 6 minutes on bench back of charging track. Men not exhausted, but literally bathed in perspiration. Much cooler on stock tracks at back of charging floor, but only one man went there. Started work at north end 2.15 p. m.; process same as before; finished 2.25 p. m. and rested 5 minutes. Started shoveling into center door 2.30 p. m.; finished 2.33. Total elapsed time during bottom making, 33 minutes; total time actually shoveling, 22 minutes. All men wore blue glasses to protect eyes; shoes had extra heavy soles, and flannel shirt sleeves were pulled down to protect arms. All young men at this plant.

The heat at the back of the furnace is not so severe, except while the metal is being run from the furnace into the ladle; but then it is intensely severe. Only one or two men are directly exposed to this heat, however, and they are in the worst of it for only a few minutes during each turn, when the metal first rushes out of the tap hole and during the period of recarburizing the metal in the ladle by shoveling or throwing in ferromanganese, slack coal, and other carburizing materials. The steel-ladle cranemen are affected by the heat from this source to a greater extent than any other employees in the department, although their exposure depends largely on the position and construction of the crane cab.

The third source of heat in the department is the pit, which always contains a certain number of ladles and ingot molds full of molten steel and always has more or less metal and slag on the floor. Here the working conditions depend largely on the method of casting and on whether the pit is kept clean or whether great quantities of metal and slag are allowed to accumulate in the pit, to be cleaned up when it is convenient. As in the Bessemer department, the greatest change in the temperature conditions of the pit came with the introduction of the method of casting the ingots in molds mounted on cars, which could be drawn one at a time in front of the steel pourers' platform. By this method, which is now used in all except a few of the older plants or in the manufacture of special castings, it is necessary to have only a few molds full of hot steel in the building at any time. In the old method of "pit casting" the molds had to stay in the pit until they were ready to be stripped from the ingots. The stripping was done on the spot with an ordinary crane, and in case the mold stuck or refused to slip off the ingot easily it was necessary for the pitmen and helpers to strike the mold with sledges until they succeeded in loosening the ingot or cracking the mold. The heat to which the workmen were subjected where "pit casting" was used was intense, and in a crowded pit, with other red-hot ingots near by, the heat could be borne by even the most hardened for only a minute or two at a time. Furthermore, where the ingots were cast in pits the mold cappers put the caps on the molds in the middle of the pit by throwing the caps. If their aim was not good, they had to walk out on top of the nearer molds, which were full of molten steel, and readjust the cap, during which time they were exposed to fierce heat from the molten steel below, as well as to the likelihood of fatal accident in case of heat prostration or a false step.

In order to show clearly the heat conditions in the open-hearth department by means of temperature readings, it is necessary to present the facts in two ways: First, the general conditions in the department are shown by giving the temperatures of the various zones in which the men work, without reference to particular operations; second, are shown the actual temperatures in which the men work while performing certain specified operations, together with a statement of the length of time taken to perform the specific task.

TEMPERATURE READINGS IN PRINCIPAL WORKING ZONES.

For the first method of presentation temperature records are available for two separate plants, representing completely different conditions. One of the plants is very old and little attention has been given to working conditions, while the other was built recently and embodies all the methods known for bettering the conditions to which the workmen are exposed. These records, therefore, make possible a study of the effect of certain simple but highly important methods of improving the conditions under which men in this department work. The outside temperatures in both of these plants at the time of making the records were nearly identical.

OPEN-HEARTHS NOS. 1 AND 2.

Open-hearth No. 1 contains six 75-ton basic furnaces. Built in 1909. Best modern brick and steel-frame construction. Unusually high and thoroughly ventilated roof, wide charging floor and pit, with gas producers entirely outside building and separated from it by stock shed. Mixer and ingot stripper isolated. Furnace walls unusually thick. All doors and ports water cooled and furnace fronts partly cooled. Metal cast in molds mounted on cars. All materials and products handled by cranes or charging machines. Practically no slag gets on floor of pit, ladles being so constructed that excess slag overflows through side spout into special slag boxes, which are removed by crane. No mill buildings adjacent to cut off breeze.

Open-hearth No. 2: Two 30-ton furnaces; built prior to 1885; altered in 1901. Small building; roof fairly high, but not well ventilated. Charging floor open on all sides. Pit side very much cramped, and walls so constructed that downward draft exists, carrying heat from furnaces out over pit. Slag allowed to run out on floor, where it lies, frequently without quenching, until favorable opportunity for cleaning up. Furnaces are thin walled and at time of observation were nearly worn out. Interior of furnaces plainly visible through openings between bricks of side walls. Doors of fire brick, nearly worn out, and no parts of furnaces water cooled. Furnaces charged by machine, and metal cast in molds mounted on cars.

Temperature readings (degrees Fahrenheit).

	Open-hearth No. 1. *Degrees.*	Open-hearth No. 2. *Degrees.*
1. Outside temperature, in shade	78	76
2. Stock shed	89	---
3. Gas-producer floor	95	---
4. On charging track	93	110
5. In front of furnaces:		
(*a*) Door closed, No. 1 at 2 feet, No. 2 at 6 feet in front (condition of inspection and test taking)	105	138
(*b*) Door partly open, 6 or 7 feet in front (condition of rabbling bottom and stirring heat)	120	[1]155
(*c*) Door wide open, 6 or 7 feet in front (gas on)	132	---
Door wide open, 6 or 7 feet in front (gas cut down) (condition of throwing or shoveling in materials)	---	140
6. Tapping platform, 8 or 10 feet from spout (watching steel run into ladle)	103	130
7. Steel pourers' platform, 5 or 6 feet from ladle	105	120

The real effect of the many desirable features of Open-hearth No. 1 is to be seen in the fact that when the doors were open, and the effect of water cooling the doors was minimized, there was only 8° difference between the temperatures in the two plants, while when the full effect of the water cooling was obtained with doors closed the difference in favor of the modern construction was 33°. Furthermore, it should be noted that in Open-hearth No. 1 there was more than twice as much metal in the furnace as in Open-hearth No. 2. Even when the value of the water cooling was lost by opening the door the difference was still in favor of No. 1, on account of the thick walls and superior ventilation. The effect of the type of construction of the building is seen in a comparison of the records of the two plants for the tapping and steel pourer's platform. The downward draft produced by the peculiar and cramped construction of No. 2, as described above, brought a great deal of the heat of the furnace down on the men at the back of the furnace and in the pit.

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[1] Gas on full and some flame issuing from door.

TEMPERATURE READINGS FOR PRINCIPAL OCCUPATIONS.

In order to show the conditions affecting the men in various occupations while they are performing various parts of their daily tasks, the following records for several open-hearth plants are presented. A detailed description of the character and construction of each plant accompanies the tables.

OPEN-HEARTHS NOS. 3 AND 4.

These two open-hearth departments form part of the same plant. They are both housed in long buildings, parallel to each other, with two stockyards and a line of 64 gas producers between the two buildings, which adds greatly to the heat and smoke of one building or the other, depending upon the direction of the wind. Open-hearth No. 3 has the river on one side, but on the opposite side is a long building containing a blooming mill and three smaller mills, which cuts it off from the breeze and also adds to its heat. The open-hearth department of this plant was not contemplated in the original plans, but was added later, consequently it had to be cramped to get it into the available space.

Open-hearth No. 3 contains twelve 75-ton furnaces. Building, though somewhat cramped, has a comparatively high roof with good ventilating arrangements, but general ventilation of building is not good on account of location and surroundings described above. Furnaces thick walled and in fairly good condition at time of observations. All doors are water cooled. Pit is narrow and cramped in comparison to large amounts of metal handled. Slag allowed to run out into pit, but is quenched immediately and not allowed to accumulate. All materials and products handled by locomotives, cranes, or charging cars. Mixer and ingot stripper isolated.

Open-hearth No. 4 contains 20 furnaces of 50 and 60 tons capacity. Building has high roof, but is badly cramped, especially on charging side, where there is scarcely passage between rear end of charging car and iron columns. Space back of charging cars where men rest is very limited and crowded with materials, machinery, and lockers, and is made more uncomfortable by heat rising from cellar.

Furnaces are thick walled and were all in good condition at time of observations. All doors are water cooled.

General pit conditions similar to those in Open-hearth No. 3.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

OPEN-HEARTH NO. 3.

Workmen exposed continuously or nearly continuously during working hours.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	82	96	On charging track, 16 feet from front of furnace. Door closed.	Charging furnaces.	Charging machine operators.	2	45	6	4	30

Workmen exposed continuously during periods specified.

2	76	122 120	Four feet from furnace door. Door closed.	Stirring heat through hole in door with long bar.	First helpers Second helpers.	12 12	1½ 1½	6 6	....	9 9
3	76	180	Four feet from furnace door. Gas on and door half open.	Barring out tap hole from front of furnace.	First helpers Pitmen.....	12 12	4¾ 4¾	1 6	....	4¾ 28½
4	76	126 170	On back platform, 3 feet from tap hole. At beginning of drilling and just as heat began to run.	Barring open tap hole from rear of furnace.	Second helpers. Pitmen.....	12 12	5	1 1	....	5 5
5	70	145	On back platform, 4 feet from tap hole.	Closing tap hole with dolomite.	Second helpers. Pitmen.....	12 12	2 2	1 1	....	2 2
6	76	142	On back platform at tap hole.	Backing up dolomite in tap hole with clay.	Second helpers.	12	2	1	......	2
7	76	96	On back platform, 15 feet from furnace.	Repairing clay lining of tapping spout.	.....do......	12	30	1	......	30
8	76	112	On back platform, 4 feet from furnace. Gas on furnace at this time.	Plastering clay around tap hole and spout.	.....do......	12	24	1	......	24
9	82	117	At approximate position occupied by steel pourer. Sides of building open at this point.	Pouring steel from ladle into molds.	Steel pourers	2	20	6	2	......
10	82	117 132	On pouring platform where molds are capped. On extension of platform where molds are uncapped. The pulpit man goes back and forth during these two zones of heat constantly, being in each about half the time. The car pusher also is in these two zones for varying periods.	Capping and uncapping ingot molds.	Pulpit men. Car pushers.	2 2	30 30	6 6	3 3	....
11	82	98	In pit at back of furnace. Cinder is wet down and allowed to cool.	Cleaning up cinder not caught by cinder box.	Pitmen.....	12	20	6	2	......

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Continued.

OPEN-HEARTH NO. 3—Concluded.

Workmen exposed continuously during periods specified—Concluded.

Number of reading.	Temperature (degrees Fahrenheit.		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
12	76 82	132 142	In an open-hearth cellar under a furnace in operation. Laborer does this work and rests when he feels like it. Very irregular.	Cleaning water seals of gas valves.	Laborer.....	1	30	4	2	......
13	76	112 106	Under an open-hearth furnace being rebuilt. The helpers work only a week at a time on this job, being transferred to the yard or elsewhere. Lower end of furnace with bulkhead knocked out admitting air from outside.	Rebuilding the brick checkerwork of the regenerators.	Bricklayers	7	30	10	5	......
					Helpers.....	21	30	10	5	......
Workmen exposed momentarily several times during period specified.										
14	76	120	4 feet in front of furnace door. Door closed. Test spoon inserted through hole in door.	Making ladle tests.	First helpers	12	½	1 to 4.	.....	[1]2
					Second helpers.	12	½		.....	[2]½
15	76	220+	2 feet from open furnace door. Unable to secure accurate record of this heat.	Banking doors with dolomite.	First helpers	12	2	1	......	2
					Second helpers.	12	2	1	......	2
16	76	155 160	5 feet in front of furnace. Door half open.	Making bottom and fixing around doors.	First helpers	12	5	3 to 6.	.....	[1]30
					Second helpers.	12	5		.....	[2]15
					Pitmen.....	12	5	......	......	......
17	76 70	180 136 140	4 feet from and to one side of half-open door. Gas turned off.	Making bottom and repairing back wall.	First helpers	12	16	1	......	16
					Pitmen.....	12	16	6	1	36
18	76	140 150	4 feet from half-open door. Gas turned off.	Fixing front wall.	First helpers	12	4	1	......	4
					Second helpers.	12	4	1	......	4
					Pitmen.....	12	4	3	......	12
19	70	135 140	4 feet from furnace, door half open.	Pitching dolomite on back wall, and using spoon to fix front and sides.	First helpers	12	5	1	......	5
					Second helpers.	12	5	1	......	5
					Pitmen.....	12	5	6	......	30
20	76	170	On rear platform of furnace, 4 feet from tap hole.	Cleaning and closing tap hole.	Second helpers.	12	10	1	......	10
					Pitmen.....	12	10	1	......	10
21	76	120	On rear platform, 15 feet from spout.	Throwing in recarburizer into ladle.	Pitmen.....	12	½	3	......	1½
22	70	142 145	On rear platform, 4 feet from tap hole. Gas turned off.	Cleaning out tap hole.	Second helpers.	12	7	1	......	7
					Pitmen.....	12	7	1	......	7

[1] Maximum.

[2] Minimum.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Concluded.

OPEN-HEARTH NO. 4.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	72	135	3 to 4 feet in front of closed door of furnace.	Barring open tap hole from front through hole in furnace door.	First helpers Pitmen	20 20	1 1	1 6	....	1 6
2	72	98 104	On pouring platform, 5 to 6 feet from ladle nozzle. Wind at back of steel pourer.	Pouring steel from ladle into ingot molds.	Steel pourers	3	20	6	2	......
3	72 76	115 118 118 120	On pouring platform, 5 feet from line of capped molds. Pulpit man passes back and forth between this position and that of steel pourer. Car pusher is exposed to both temperatures, but is chiefly exposed to heat intermediate between the two.	Lifting heavy caps from ingot molds with aid of suspended lever. Men get heat from full line of hot molds.	Mold cappers Car pushers	3 3	30 30	6 6	3 3	....

Workmen exposed momentarily several times during period of exposure specified.

Number of reading.	Outside in shade.	At position specified.	Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Hrs.	Minutes.
4	82	125	6 feet in front of furnace door. Door raised only long enough to throw materials in.	Throwing in ferromanganese and similar materials.	Pitmen	20	3	(1)	......	[2] 18
5	78	145 158 160	On rear platform, 4 feet from open tap hole after heat has been poured. Men are actually in heat only 2½ minutes. They rush into it for 20 or 30 seconds, this being as much as they can stand at a time.	Cleaning out and closing tap hole with dolomite.	Second helpers. Pitmen	20 20	10 10	1 1	....	10 10

[1] Not more than once for each of 6 furnaces.

[2] Maximum.

OPEN-HEARTH NO. 5.—FIVE 75-TON STATIONARY FURNACES.

Charging side: Floor elevated; open at back with good draft through from ends and back; high roof, modern plans as to construction; seats for men along the back; comfortable quarters; furnaces charged by machine and have firebrick doors which are not water-cooled. Pit side: On ground level; well ventilated and ample room for tracks and pouring platforms and for making repairs.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

OPEN-HEARTH NO. 5.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes.)	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade	At position specified.							Hrs.	Minutes.
1	7	130	5 feet from furnace front. Doors closed.	Splashing slag out of furnace.	First helper.	1	2	1	......	2
					Slagmen....	4	2	4	......	8
2	70	126	8 feet from tap hole. Heat just tapped.	Recarburizing and watching metal run.	Melter......	1	4	1	......	4
					Second helpers.	4	4	4	......	16
3	70	126	On rear platform, 3 feet from tap hole, immediately after closing.	Closing tap-hole with magnesite and clay.	Second helpers.	2	20	2	......	40
4	70	85	On pouring platform, 6 feet from ladle nozzle.	Pouring steel from ladle into ingots.	Ladleman...	1	25	5	2	5
					Pitmen.....	3	25	5	2	5
5	70	85	On pit floor where slag is cleaned up. No furnaces being tapped. General temperature in which pitmen and slagmen work except when on charging floor.	Cleaning up slag and floor generally.	Slagmen....	5	30	5	2	30
					Pitmen.....	3	30	5	2	30

Workmen exposed momentarily several times during periods specified.

Number of reading.	Outside in shade	At position specified.	Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes.)	Number of times repeated on each turn.	Hrs.	Minutes.
6	70	140	5 feet from furnace front. Door open.	Patching furnace, using shovels.	First helper.	1	13	1	......	13
					Slagmen....	4	13	4	......	52
7	70	140	.....do................	Patching furnace, using scoops.	First helper.	1	4	1	......	5
					Slagmen....	4	4	4	......	16

OPEN-HEARTH NO. 6.

Six 45-ton tilting furnaces, arranged in rows of three furnaces, with deep subsurface pits between the two rows. The casting is not done in these pits, but either in other subsurface pits at the end of the furnace rows, or in molds mounted on cars which pass in front of a platform at the same end of the building.

Charging floor for first row of furnaces on the ground floor is very narrow, there being only a clearance of a few feet between rear of charging machine and row of gas producers which are inside the building and extend along the entire row of furnaces. The charging side of first row of furnaces is thus completely inclosed and is unusually hot. The furnaces also have firebrick doors, and are not water cooled at any part. Much flame issues from the doors when the gas is on. The floor is so hot and crowded that the men, except when working, retire to the open spaces at the end of the row of furnaces.

Charging floor for second row of furnaces is as narrow as for the first, but is not so hot, as there are no producers on this side. This side is also open to the air along a good part of its length.

The pits are subsurface and are very deep. Situated as they are between the two rows of furnaces they are very hot at all times, and this heat is greatly increased by the presence for a large part of the time of hot slag boxes. The men have tunnels for escape in case a furnace breaks out or a ladle is overturned.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

OPEN-HEARTH NO. 6.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	69	98	Near center of charging-car track.	Charging materials into furnace.	Charging machine operator.	1	Variable.	Variable.	8	45
2	69	126	On platform at back of furnace, about 15 feet from tap hole and ladle.	Tapping metal from tilting furnace.	Melter......	1	7	3-10	[1] 1	[1] 10
					Second helper.	1	7	3-10	.....	[2] 30
					Stockers.....	3	7	3-10		
3	69	112	On pouring platform, position of ladleman.	Pouring metal from ladle into molds.	Ladleman...	1	20	6-10	[1] 3	[1] 20
					Pitmen.....	2	20	6-10	[2] 2	......
4	78	108	In pit for bottom casting. General temperature while preparing pit.	Runner making mold setting.	Pit labor....	3	15	8	2	......

Workmen exposed momentarily several times during periods specified.

5	72	130	5 or 6 feet from front of furnace, door open.	Fixing bottom with dolomite, etc.	Second helpers.	1	30	1	......	30
					Slagmen....	3	30	3	1	30

[1] Maximum. [2] Minimum.

OPEN-HEARTH NO. 7.—TWO 30-TON STATIONARY FURNACES.

Charging floor practically on the ground level; circulation of air poor, and general conditions as to heat bad, due to the narrow space on the charging floor and to the fact that one side of the charging floor is almost closed in. The gas producers are located along and very close to this side of the building and add to the heat. Men retire to ends of building when resting. At times heat conditions are made worse by trucks with pans of hot crop ends from bloom mill standing on the track just outside the open end of the building. Furnaces charged by machine and have fire-brick doors. No parts are water cooled. Subsurface pits very hot places in which to work, and little chance for escape in case of explosion, splashings from ladle, or tipping of ladle. Tunnels for men to run to in case of danger. Practically no air circulation.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

OPEN-HEARTH NO. 7.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
Workmen exposed continuously during periods specified.										
1	70	115 130 120	Near edge of bottom cast pit at position of ladleman.	Pouring steel from ladles into ingots.	Ladleman...	1	18	2	......	36
					Pitmen.....	2	18	2	......	36
Workmen exposed momentarily several times during periods specified.										
2	78	130 125 143	Five feet from furnace front. Doors closed.	Test taking and bottom fixing.	Melter......	1	½	10	......	5
					First helpers	2	½	10	......	5
3	78	118	On back platform of furnace, near tapping hole.	Opening taphole.	Second helpers.	2	5	2	......	10
4	75	142	On back platform, 8 feet from tap hole, while metal is running.	Recarburizing and watching ladle.	Melter......	1	5	2	......	10
					First helpers	2	5	2	......	10

PUDDLING MILLS.

In the puddling mills the workmen not only are exposed to considerable heat but during the period of exposure they perform very severe manual labor, which of itself would be exhausting even if done under the most comfortable conditions. There has been no important change in the process of puddling during the past 50 years, but working conditions have been somewhat improved.[1] The improvements in working conditions have consisted largely in the installation of water-cooled doors and provisions for artificial ventilation, and in the better design and construction of the grates and other provisions for firing the furnaces. These improvements, however, have been somewhat offset by the fact that the size of the charge which is handled in a single "heat" has been increased, and less time is lost between the "heats" than was formerly the case.

In the table below are shown the temperatures to which the puddlers and helpers are exposed during the course of a complete "heat," from the charging of the pig iron until the puddled iron is removed from the furnace and carried down to the "squeezer." The day on which these temperature records were made was unusually hot, and for that reason the temperature conditions shown in this table can not be taken as representing normal conditions, even during the summer months. The day referred to was in fact so hot that the company ordered the day shift to stop working after making four heats, and limited the night turn to three heats. Nevertheless, the general temperature in puddling is about as much higher than the outside temperature as is shown by the figures presented here. That is to say, normally the puddler and his helper are exposed while doing the severest manual labor to a temperature ranging from 20° to 35° above the outside temperature at the time. During each "heat" each of the men in the puddling crew is exposed to this temperature for about 35 minutes, and as five "heats" ordinarily constitute a day's work, the total time of exposure is about three hours. The furnace door on this particular puddling furnace was water cooled, the water being sprayed over the door in a series of jets. A much better type of water-cooled door, which is in use in a number of puddling mills, consists essentially of a hollow iron door through which the water circulates. If the circulation is sufficiently rapid, such a door entirely cuts off the heat from the interior of the furnace.

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[1] A minute description of the process of puddling as practiced in 1859 is available and shows that the work was in every detail exactly the same as at the present time.

PUDDLING FURNACES: TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	95	120	4 feet from door of puddling furnace; door up.	Charging......	Puddlers.... Puddlers' helper.	2 1	[1] 1½-5	5	......	[2] 25 [3] 7½
2	95	115	2 feet from door; door closed.	Boiling.......	Puddlers' helpers.	2	(4)	5	1	40
3	95	115	do	do	Puddlers.... Puddlers' helpers.	2 2				
(5) 4	94	120	do	do	Puddlers.... Puddlers' helpers.	2 2				
5	94	125	do	do	Puddlers.... Puddlers' helpers.	2 2				
6	94	122	do	do	Puddlers.... Puddlers' helpers.	2 2				
7	94	120	do	do	Puddlers.... Puddlers' helpers.	2 2				
8	94	115	3 feet from door; door closed.	Balling.......	Puddlers....	2	10	5	......	50

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[1] 1½ minutes for charging first heat by fresh crew, usually takes 5 minutes for other heats made by same crew; men exposed about 5 seconds each time they pitch in materal.

[2] Maximum.

[3] Minimum.

[4] Exposed to heat all the time specified, but the men take turns so that the time in heat is halved; in other words, in an interval of 40 minutes one puddler on each side of furnace was in heat 20 minutes, and likewise one helper.

[5] During the period slag was boiling out through wicket into slag buggy below, and men worked over this hot slag.

PUDDLING FURNACES: TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Concluded.

Workmen exposed momentarily several times during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
9	94	130	3 feet from door; door open.	Taking out balls.	Puddlers....	(1)	5	(1)	......	[2] 15 [3] 10

[1] One man at a time; that is, one puddler takes out the balls for two heats each turn, and the other puddler takes out the balls for three heats each turn.

[2] Maximum.

[3] Minimum.

In addition to the puddlers and helpers whose working conditions as to temperature are shown in the above table there are, of course, a number of other men in the roll crew of the puddling mill who are exposed to great heat. Their condition, however, is almost exactly the same as that of the rolling crew in the small rolling mills, which will be described in detail later.

ROLLING MILLS.

The conditions of extreme heat in the rolling mills arise from two different sources, the furnaces and the hot metal which must be handled in passing through the mills. In the modern mills in which all operations are performed by mechanical devices few men handle the hot metal at any point in the process. They are, however, exposed to the heat radiated from the furnaces and from the hot metal during the various stages of the process, so that even in the most highly developed mills a number of men are still exposed to high temperatures.

BLOOMING AND SLABBING MILLS.

Charging Cranemen.—The most conspicuous of these positions of exposure is that of the craneman who charges steel into the furnaces or soaking pits and removes it when it is heated. In the blooming and slabbing mills particularly this position is very exhausting. The cranes for charging the steel ingots into the soaking pits are suspended immediately over the pits, and the craneman in his cab receives the full heat rising from the pits and from the large ingots which are still red hot at the time they are handled. This position is exposed to such heat that when the idea of using soaking pits and drawing the ingots from them by means of overhead cranes was first proposed it was believed that a great obstacle to its success would be the difficulty of securing men who could stand the terrific heat for a sufficient length of time. In a report to the British Iron Trade Association of 1902, concerning the use of the pit cranes, is the following statement:[1]

> The one great trouble found with this crane has been the uncomfortable position of the crane driver, owing to the heat, and in warm weather his powers of endurance have been the measure of the possible output. Relays of fresh hands have had to be found in order to relieve each other at intervals.

For this reason in many of the blooming mills the pit cranemen work only eight hours a day, and in all the mills arrangements are made to relieve them whenever it is necessary. Nevertheless, the position is one of the greatest severity, for in addition to the great heat rising from the soaking pits, the work is done in an atmosphere of smoke and gaseous fumes which in themselves are very nearly overpowering.

HEATING CREW.—The other men working around the furnaces and soaking pits in the large mills are also exposed to extreme heat, but for most of these men the exposure lasts for only a very short time and, consequently, is decidedly less exhausting than the more prolonged heat to which the pit craneman is exposed. The work of bottom making, that is, repairing the bottoms of the soaking pits, is extremely severe, since the workmen necessarily are exposed to the full heat from the red-hot pits in leveling up the bottom and putting in fresh coke dust. These same men also remove the cinder from the bottom of the pits. In doing this they have to go into the cellar underneath the pits and sometimes remain there for several minutes at a time. The heat in this cellar is almost unbearable. Only one record was obtained, but it was secured under the most favorable conditions, when the pits were empty, the gas was off, and the cellar had just been cleaned up. At this time the temperature was 150°, and the agent in making the observation was able to remain in the place only long enough to allow the thermometer to register correctly. There is absolutely no fresh air in this cellar under ordinary conditions, so that in addition to the heat there is a lack of sufficient oxygen and an excess of smoke and gaseous fumes.

The conditions around the soaking pits in the mills are very much better than they were 20 or even 10 years ago. One of the most important improvements has been in the use of charging cranes in which the tongs for gripping the ingots are guided entirely by the crane operator. Formerly the tongs had to be opened and shut and guided into place on the ingot by the pit tongsman who controlled a pair of reins which opened and shut the jaws of the tongs. In performing this work he had to pass directly over the soaking pits and, besides being exposed to extreme heat, was in imminent danger of falling into one of the red-hot pits in case of a misstep.

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[1] Enoch James, in American Industrial Conditions and Competition: Report of the British Iron Trade Association Commission, 1902, p. 545.

ROLLING CREW.—The men who actually control the operation of rolling in the best equipped mills have their position on an elevated platform situated some 20 feet from the rolls and, consequently, are not exposed to the direct heat from the hot ingots. The radiated heat, however, generated by the enormous masses of hot steel is usually sufficient to raise the temperature of this position 10° or more above the outside temperature. In some plants the men on this platform are shielded from the heat by the use of water-cooled screens, glass shields, or, in some cases, by the provision of curtains which can be regulated so as to cut off at least a part of the radiated heat. In many cases also electric fans are provided, and when these are of sufficient size to create a current which will blow the heat away from the platform they are of great service. A few blooming mills still exist in which there are no mechanical devices for turning the ingot over on the table; in such mills it is necessary for men to stand on the table and, with a large wrench, turn the ingot over to allow it to pass over the roll. This, the general practice less than 20 years ago, subjects the men who perform the work to the most extreme heat. The manual labor performed in turning over the large ingots is very severe and, combined with the very high temperature in which the work is performed, makes it necessary for the men to be relieved at frequent intervals to prevent their complete prostration. In many of the more highly developed mills it is necessary for workmen to stand alongside the table and straighten the blooms in case they get out of the reach of the "manipulator," and in the slab and plate mills the use of such men (known as "hookers") is a common practice. The records which were taken for men performing this work show that when the outside temperature was 85° the hookers were exposed to a maximum temperature of 130° and a minimum temperature of 120°, the variation in temperature depending upon whether the plate was on the side of the rolls toward the hooker or on the opposite side. In considering these temperatures, however, it must be understood that while the piece of metal is not being rolled there is a drop in the temperature beside the roll table of some 15° or 20°, and, in addition, if there is a delay of any considerable duration, as is frequently the case, it is possible for the men to go entirely away from the roll table and get a breath of fresh air.

Shearmen and Helpers.—Another large crew of men who are exposed to unusual heat conditions in mills of this general type is that of the shearmen and helpers. Under normal conditions, when the shears are working right and the blooms lie straight on the shear table, no exposure to extreme heat is necessary. It frequently happens, however, that it is necessary for one or more of the helpers to be exposed to very high temperatures in order to straighten the blooms so that the shears can make a proper cut. In practically all blooming mills existing at the present time mechanical conveyers are provided to take the short crop ends away from the shears and load them on trucks. In some cases, however, no such provision is made, and a small gang of laborers is employed to drag these red-hot crop ends away with tongs. The heat encountered in performing this work is not unusually great, but the work is done continually in a comparatively high temperature and is somewhat exhausting for that reason.

The particular blooming mills for which temperature records were secured were not of the most modern construction, and several positions in those mills had conditions of the most extreme temperature connected with them. The first of these positions is found in Blooming Mill No. 1, reading No. 6, which shows the working conditions for the shearmen's helpers. In this particular mill it was necessary for the shearmen's helpers to hold the bloom against the stop while the shear was making the cut. In doing this they were exposed for about two minutes to a temperature of 120°, the outside temperature being 87°. In some of the more recently designed shears this is done automatically, and it is not necessary for the men to be exposed in such a temperature as this unless some of the metal goes wrong.

Another condition of extreme heat in the mill referred to is connected with the loading of the blooms after they have been sheared. In this mill the loading was done by means of a jib crane from which tongs were suspended. Two men handled the tongs at one time and worked for 15 minutes without intermission. They then rested for 15 minutes, being spelled by other workmen. This condition is found in connection with position No. 4, Slab Mill No. 1. On the day when the readings were made the temperature in which these loaders worked was 135°, the outside temperature at the time being 85°. It should be noted also that this work is not performed inside the mill building, but under an uninclosed roof immediately at the end of the building. The excessive temperature connected with this operation comes not so much from the particular billet or slab which is being loaded at the time as from the cars full of hot slabs or billets on the tracks alongside. With the wind blowing across these cars the heat is almost unendurable and the loaders are almost exhausted when their 15 minutes of work is finished. The physical labor performed by these men in handling billets and slabs would of itself be exhausting even if it were done under conditions of moderate temperature. The necessity for this extremely exhausting labor is obviated in most plants by the use of a billet conveyer or a small electric crane provided with a cradle for lifting the billets.

Ingot Strippers.—In the plant to which the temperature conditions shown apply the ingot stripping was done directly in connection with the blooming mill, and the workmen operating the stripping crane was exposed to a temperature of 119° when the temperature in the shade was 90°; his work required him to be exposed to this temperature for about 8 hours out of the total 12 hours of the working day. In a majority of the plants the ingot stripper is entirely detached from the blooming mill and is usually so situated that whatever breeze may be blowing will reach the man in charge of the stripping crane. Under such conditions the temperature is somewhat lower than the particular condition shown here, but even under the best conditions it is an extremely hot and exhausting position.

In the following table are shown the temperature conditions existing in connection with the various occupations in two blooming mills and one slab mill. Slab mills, it may be remarked, are classed in with the blooming mills, rather than with plate mills, because the heat conditions of greatest consequence—that is, those in connection with the soaking pits—are common to both blooming and slab mills. No comment on these figures seems to be necessary in view of the rather elaborate analysis of conditions which has been given above.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

BLOOMING MILL NO. 1.

Workmen exposed continuously, or nearly continuously, during working hours.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	84 90 91	89 100 100	Roller's platform, behind glass shield; electric fan provided, but not used at time of these readings.	Operates lever controlling roll table and manipulators.	Roller......	1	......	......	[1] 12	......
2	91	107	Beside shears at position occupied by bloom shearman.	Shear blooms..	Shearman...	1	......	......	[1] 12	......

[1] Less delays.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Continued.

BLOOMING MILL NO. 1—Concluded.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes.)	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade	At position specified.							Hrs.	Minutes.
3	88	[1] 150	In cellar between soaking pits; door of one pit furnace open.	Tap cinder; make bottoms.	Heaters' helpers.	2	[2] 30 [3] 60	4 [4] ½	2	 30
4	90	119	Platform from which stripper crane is operated.	Removing molds from ingots.	Stripper men.	2	([5])	......	8	......
5	90 90	115 125	In cage of charging crane; fan going. Same position; no fan going.	Charging and drawing ingots from soaking pits.	Cranemen...	2	......	......	9	......
6	87	120	At hook beside shears.	Hold bloom end against stop while shearing.	Shearmen's helpers.	3	2	60	2	......
7	91 87	119 118	At loading tongs near shears.	Load blooms and scrap after shearing.	....do......	3	3	60	3	......

BLOOMING MILL NO. 2.

Workmen exposed continuously or nearly continuously during working hours.

Number of reading.	Outside in shade	At position specified.	Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes.)	Number of times repeated on each turn.	Hrs.	Minutes.
1	65	80	Roller's platform over roll table.	Operating levers controlling rolls, engine, roll table, and manipulator.	Roller....... Roll engineer Manipulator	1 1 1	....	....	[6] 12 [6] 12 [6] 12	....
2	65	90	At trucks near shears facing hot-sheared billets.	Keep billets straight as they fall on truck.	Loaders.....	3	......	......	[6] 12	......

Workmen exposed continuously during periods specified.

Number of reading.	Outside in shade	At position specified.	Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes.)	Number of times repeated on each turn.	Hrs.	Minutes.
3	65	100	Beside roll table......	Turn bloom on edge and hold till it enters rolls.	Table man..	1	1	150	2	30
4	65	78	Beside billet shears in outside shed.	Shearing and stamping billets.	Shearman... Stamper....	1 1	3 3	150 150	7 7	30 30

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[1] At this time pits empty, gas off, and cellar cleaned up. Brisk wind down river. Practically best conditions at this time of year with mill in operation. Men come out from time to time for air.

[2] Tap cinder.

[3] Make bottom.

[4] Average.

[5] Irregular.

[6] Less delays.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Concluded.

SLABBING MILL NO. 1.

Workmen exposed continuously or nearly continuously during working hours.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	85	100	Platform for roller and table engineer.	Operate levers controlling rolls and tables.	Roller......	1	......	......	[1] 12	......
					Table engineer.	1	......	......	[1] 12	......
2	80	[2] 93 [3] 105	Manipulator platform. Temperature affected by passage of ingot.	Operate manipulator levers.	Manipulator.	1	......	......	[1] 12	......
3	85	97	12 feet from shears....	Shearing slabs.	Shearman...	1	......	......	[1] 12	......
					Shearman's helper.	1	......	......	[1] 12	......

Workmen exposed continuously during periods specified.

4	85	135	At position occupied by loader in handling slabs and billets.	Loading slabs and billets on trucks.	Loaders.....	[4] 4	15	24	6	......

[1] Less delays.
[2] Minimum.
[3] Maximum.
[4] Two men work 15 minutes at loading tongs, then rest 15 minutes, being spelled by other two loaders.

PLATE MILLS.

The temperature conditions existing in the plate mills differ in some important respects from those described in connection with the blooming and slabbing mills. In the first place, the furnaces in which the slabs are reheated are usually horizontal. A horizontal crane is used in charging the slabs for these furnaces and, while the craneman is not required to be exposed to the direct heat rising from soaking pits beneath him, the temperature to which he is exposed when the large doors of the slab-heating furnaces are open is extremely high. The exact conditions depend largely on the type of crane or machine which is used. In some of these machines the cab is so arranged that the craneman is brought very close to the furnace door when the carriage moves forward to put the slab into the furnace or to draw it out. In machines of another type the cab is fixed and the carriage moves forward under the control of the craneman without carrying him into a zone of unusual heat. Nevertheless, under the very best conditions, the heat to which the workmen performing this particular operation are exposed is unusually great. In the particular plate mill for which temperatures are shown here the temperature in the cab of the charging crane was 115° when the outside temperature was 88°. The position of the charging craneman for horizontal furnaces is superior to that of the craneman connected with soaking pits in that there is usually much less exposure to fumes, smoke, and exhausting gases.

As severe as this work is, however, conditions are very much better than those which existed in the plate mills less than 20 years ago. At that time the slabs were charged into furnaces by hand on long, flat bars known as "peels." Four men were usually required to handle the peel in charging large slabs. In addition to performing the hardest manual labor they were brought directly up against the furnace door and there they had to stand, exposed to the full heat, until they could properly adjust the peel so that the piece would be placed at exactly the right position. There is at least one mill in Pittsburgh in which these very conditions can still be seen.

Similarly, in handling the slabs at the rolls a great improvement in the working conditions has come through the use of mechanical devices. In the old plate mills four men were usually required on each side of the rolls to handle the plate. Hot scale was blown off the plates and flew back against the men, and though they protected themselves by wearing wire masks and leather aprons they were frequently severely burned by the explosions. Moreover, in order to handle the plate it was necessary for them to be very close to it, and as most of the older plate mills were only "two-high" the plate had to be lifted to the level of the top roll in passing it back after each pass. It is almost impossible to give a correct appreciation of the extreme conditions of heat and danger under which these men worked, and although the hookers who are required alongside the roll table in the modern mills work under somewhat exhausting conditions, their condition is immensely superior to that of the men in the plate mills of the type used some 20 years ago. Some conception of the conditions under which this work was performed will be gained from reading the detailed description of one of the plate mills of this type, as it existed in 1895. The description was written by the former superintendent of that mill. (See pp. 515–522.) An almost equally great advance has been made in alleviating the conditions connected with handling the plates after rolling. Under the old conditions the plates passed out on the floor of the mill and were then dragged either by men or mules over the iron plates which formed the floor of the mill down toward the finishing end of the mill. The constant passage of these red-hot plates made the iron floor of the mill extremely hot, and it is impossible, from any work now done in the steel industry, to form any conception of the exact conditions to which the men who dragged these plates were exposed. Even when mules were used to do the actual hauling of the plates the men had to lift the plate on and off the buggy, and in doing this were exposed to the full heat from the plates. The heat was rendered even more disagreeable and exhausting by the fact that the floor was frequently sprinkled in order to keep down the dust and to cool the floor as much as possible. In consequence, a cloud of steam almost constantly enveloped these workmen. The plates were straightened either by the use of sledges or by rolling heavy iron rollers back and forth over the surface of the plates. In doing the work by either of these methods the men were exposed to the most extreme heat.

Under modern methods the plate is not handled at all by hand from the time it reaches the rolls until it reaches the shears, the only work of the men in connection with it consisting in marking it for shearing after it has become fairly cool in passing through the straightening rolls. The straightening, furthermore, is done automatically by means of a device which has been described in preceding pages of this report.

In the following table are shown the temperatures for three positions in one of the more modern plate mills:

PLATE MILLS: TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	88	115	Cab of charging crane.	Charging and drawing slabs.	Charging cranemen.	2	30	12	6	......
2	87	[1] 98 [2] 100	Screwman's platform. Highest temperature when slab was on same side of rolls as platform; lowest when on opposite side.	Operates screw.	Screwman..	1	......	......	[3] 12	......
				Operates manipulators, table, and table rollers.	Table leverman.	1	......	......	[3] 12	......
3	85	[1] 120 [2] 130	At hookers position. Highest temperature when slab was on same side of table as hooker; lowest when on opposite side.	With long hook turns slab and guides it into rolls.	Hookers.....	2	......	......	[3] 12	......

[1] Minimum.

[2] Maximum.

[3] Less delays, with very brief interval of lower temperature between slabs.

BAR AND OTHER SMALL MILLS.

The temperature conditions in the small mills do not require any very extended comment in view of what has already been said about the various conditions in the larger mills, the chief difference consisting in the fact that in the small mills the pieces of metal handled are smaller and the operations are more largely performed by hand. In most of the smaller mills erected at the present time the furnaces are of the continuous type, and when the work is going properly the men connected with the furnace crew are not exposed to any great heat. It sometimes happens, however, with these furnaces that the billets become disarranged on the hearth of the furnace or stick to the hearth. In such cases it is necessary for the men to straighten up the billets or to pry them loose from the floor of the furnace. In doing this they are exposed to extreme heat and can work for only a few minutes at a time. The work must necessarily be done rapidly, as any delay of this kind is likely to cause the loss of an entire heat of billets. With the older furnaces, from which the metal is charged and drawn by hand, the various men connected with the furnace crew are exposed to very high temperatures, and moreover perform extremely hard work during the time of their exposure.

The men in the rolling crew perform very hard work under conditions of comparatively high temperature. The heat to which they are exposed rises partly from the pieces of steel which they are handling, partly from the rolls, which of course become highly heated as the hot pieces of steel pass over them, and partly from the hot metal plates which form the floor of the mill. During the summer months these plates are so hot that the men are forced to wear shoes with heavy soles of wood or leather to protect their feet. Even with this protection the feet become badly calloused.

The men who drag the bars and other small pieces of steel out onto the hot beds are, of course, exposed to considerable heat and are particularly subject to the heat rising from the cast-iron plates which form the floor of the mill. In many of the more recently constructed mills automatic conveyors have done away with the necessity for this work.

TUBE MILLS.

Some of the severest work in the steel industry under the old conditions was that in the tube mills. The severity of the work arose from the fact that practically all the operations connected with the making of tubes have to be performed close to the furnace in order that the steel or iron may be formed into pipe while it is still at a welding heat. Furthermore, in the early days of the industry certain technical reasons also made it convenient to have the steel charged in the furnaces from pits below the general level of the mill. In these pits the workmen were entirely cut off from the outside air, and while performing hard manual labor were exposed to extremely high temperatures.

Welded tubes are made by two different processes, known, respectively, as "lap welding" and "butt welding." In lap welding the edges of the steel are lapped over and the weld is formed by rolling the lapped tube over a mandrel. In butt welding the edges are simply brought up against each other and welded in this position by drawing the tube through a bell-shaped die.

The temperatures for tube mills were obtained in two plants. In Tube Mill No. 1 the conditions shown represent, perhaps, the very best conditions existing in connection with this work in any plant of the country. Almost every device which can in any way relieve the workmen has been installed, and the building in which the tube mills are housed is particularly comfortable during the summer months on account of its large size and unusually high roof. The very great effect of the installation of various devices for alleviating the heat in this mill can be clearly seen in the records which are shown in the following pages. For example, in Tube Mill No. 1 the temperature in the butt-welding furnace for position No. 1, that of the welder, was 116° when the electric fan was being run and 132°, or 16° higher, when the fan was stopped. Similarly, in position No. 2 the temperature was 94° with the fan in operation and 116°, or 22° higher, without the fan in operation. Besides the electric fans at these positions, the men were also protected from the heat of the furnaces by water-cooled shields and in various other ways. Consequently, the extreme temperature to which the men in these positions would have been subjected without the use of protecting devices was probably as high as 150°. It should be noted that much of the effect of these fans came from the fact that they were inclined at such an angle that the hot air was blown upward and in this way rapidly removed from the workmen. In Tube Mill No. 2 a different and less satisfactory system of cooling the air is used. This consists in the use of special ventilating pipes which convey the air from a central fan blower. These pipes probably supply almost as much air as the fans in Tube Mill No. 1, but their general position tends to bring the heat, which would naturally rise, down on the workmen instead of carrying it away.

The principal difference between the heat conditions in lap welding and butt welding consists in the fact that in the former method the pieces are of large size and the exposure from each piece lasts some time, while in butt welding the pieces are very much smaller and there is less heat from the individual piece; but at the same time the work is done so rapidly that there is an almost constant succession of hot tubes passing each working position. The description of the general operations in the tables which follow are sufficiently clear to make further comment on the temperature conditions in these mills unnecessary. It should be noted that in each of the two plants temperatures are shown for both butt welding and lap welding.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS.

TUBE MILL NO. 1—LAP-WELD FURNACE.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	85	[1] 98 95	30 feet from furnace..	Charging skelp into furnace.	Chargers....	2	[2] 30	11	5	30
2	85	[3] 98	6 feet from trough....	Operating electric controllers for 2 sets of rolls.	Size and cross rollers.	2	[4] 45	11	8	15
3	85	[1] 98	3 to 4 feet from end of pipe.	Rolling pipe over to back ender.	Takers-off...	2	[4] 45	11	8	15
4	85	[1] 90	33 feet back from furnace.	Operating bar-pulling machinery.	Bar pullers..	2	[4] 45	11	8	15

Workmen exposed momentarily to heat several times during periods specified.

Number of reading.	Outside in shade.	At position specified.	Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Hrs.	Minutes.
5	85	[3] 98	3 feet from furnace and bending box.	Pulling skelp out of furnace and into bending die.	Benders.....	2	[4] 45	11	8	15
6	85	[3] 124	12 feet back from furnace.	Rolling pipe into welding trough.	Turners-down. Pit hand....	2 1	[4] 45	11	8	15
7	85	[3] 96	26 feet back of furnace.	Rolling pipe into trough of charging machine.	Pit hands...	4	[2] 30	11	5	30
8	85	[1] 98	6 feet from furnace and rolls.	Putting balls on bar.	Ballers......	4	[4] 60	9	9	......

[1] No fan.

[2] Then rest 30 minutes.

[3] Electric fan. Where the working positions are not covered by fans they are not needed.

[4] Then rest 15 minutes.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Continued.

TUBE MILL NO. 1—BUTT-WELD FURNACE.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	87 66	[1] 116 [2] 132 [1] 112 [1] 96 [1] 110	6 feet from drawing end of furnace.	Welding......	Welders.....	3	[3] 15	14⅔	3	40
2	87 66	[1] 94 [2] 116 [1] 88	4 feet in front of drawing end of furnace.	Bell cleaning..	Bell cleaners.	2	[4] 15	22	5	30
3	87 66	[1] 136 [1] 102 [1] 110	10 to 12 feet from charging end of furnace.	Straightening skelp in furnace.	Pickers.....	2	[4] 15	22	5	30
4	87	[1] 108	4 feet from draw bench in front of furnace.	Running back with hook attached to pipe.	Hook runners.	3	[4] 30	14⅔	7	20
5	87 66	[1] 124 [1] 126 [1] 100 [1] 102	At bench, 12 to 14 feet from front of furnace.	Rolling off hot pipe.	Size rollers..	2	[4] 15	22	5	30
6	87 66	[1] 104 [1] 86	At seat back of fan, 16 to 20 feet from front of furnace.	Moving bench.	Bench movers.	3	[4] 30	14⅔	7	20
7	87 66	[5] 104 [5] 74 [5] 76	At end of bench, 48 feet from front of furnace.	Removing tongs from hot pipe.	Take-off tongs.	3	[4] 30	14⅔	7	20
8	87 66	[5] 104 76	At cross rolls, 8 feet from end of bench.	Cross rolling...	Cross rollers.	2	[4] 30	14⅔	7	20

TUBE MILL NO. 2—LAP-WELD FURNACE.

Workmen exposed momentarily several times during periods specified.

1	92	[6] 122	12 feet from charging end of bending furnace.	Pushing skelp into place and bending corners of same.	Poke-ins	3	[3] 15	14⅔	3	40
2	92	[6] 112 [6] 110	12 feet from drawing end of bending furnace.	Operating motor of scarfing machine.	Heaters.....	2	[4] 15	22	5	30
3	92	[6] 120	Along drawing bench, 4 to 5 feet from end of hot pipe.	Catching pipe with hook and walking back with it.	Hook runners.	2	[4] 15	22	5	30
4	92	[6] 132 [6] 120	12 feet back from front of welding furnace.	Rolling pipe into trough and pushing pipe into welding rolls.	Roll-overs...	3	[3] 15	14⅔	3	40
5	92	[5] 108	At welding rolls, no pipe running through rolls.	Putting ball on bar.	Ball men....	2	[4] 15	22	5	30

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[1] Covered by electric fan.

[2] No electric fan. Heat due to passage of long pipe (40 feet) and the fact that man holds end with tongs and is close to end of pipe.

[3] Then rest 30 minutes.

[4] Then rest 15 minutes.

[5] Temperature reading with fan stopped.

[6] Position covered at time temperature was taken by pipes carrying blasts of air from blower fan.

TEMPERATURE CONDITIONS TO WHICH WORKMEN ARE EXPOSED DURING PARTICULAR OPERATIONS—Concluded.

TUBE MILL NO. 2—BUTT-WELD FURNACE.

Workmen exposed continuously during periods specified.

Number of reading.	Temperature (degrees Fahrenheit).		Position at which temperature was taken.	Operation performed at this position.	Occupations of men affected.	Number of men affected on each turn.	Duration of each exposure (minutes).	Number of times repeated on each turn.	Total time each man is exposed during each turn.	
	Outside in shade.	At position specified.							Hrs.	Minutes.
1	92	[1]130 [1]132	8 feet back of charging end of furnace.	Poking in and shoving up skelp.	Poke-ins.... Shove-ups...	4 2	[2]20	16	5	20
2	92	[1]130	4 feet from drawing end of furnace.	Catching skelp with tongs and putting bell over tongs.	Welders.....	3	[3]20	11	3	40
3	92	[1]118	Alongside drawing bench with hot pipe passing.	Catching tongs with hook and walking back along bench.	Hook runners.	3	[2]20	16	5	20

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[1] Positions covered at time temperature was taken by pipes carrying blasts of air from blower fan.
[2] Then rest 20 minutes.
[3] Then rest 40 minutes.

CHAPTER XIII.

WORKING CONDITIONS AND EFFICIENCY AS AFFECTED BY THE SPEED AND SEVERITY OF THE WORK.

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WORKING CONDITIONS AND EFFICIENCY AS AFFECTED BY THE SPEED AND SEVERITY OF THE WORK.

INTRODUCTION.

The most striking characteristic of the American steel industry has always been its tremendous productive efficiency. Although the American steel makers have contributed much to the improvement of the quality of steel and to the economy of its production, their efforts have been directed principally to securing the largest outputs which the equipment at their disposal was capable of turning out, and to devising such improvements in the equipment that still greater production might be secured. The American steel makers' habit and boast of "beating the record" has always been a byword in the industry.

Some conception of the tremendous increases in productive efficiency may be given by the statement that in the 40 years from 1869 to 1909 the annual output of the blast furnaces increased from 66.5 tons per man to 596.4 tons. The average annual product per man in 1909 was therefore nine times as great as in 1869. Similarly in the steel works and rolling mills the annual production of finished products increased from 28.8 tons per man to 102.4 tons. In this branch of the industry therefore the production per employee in 1909 was three and a half times as great as in 1869. A clear insight into the general nature of these increases in productive efficiency and in the periods during which they took place is given in the following table compiled from reports of the Bureau of the Census. It should be noted that in the case of steel works and rolling mills the real increases in productive efficiency have tended to be obscured by the fact that there has been a constant tendency toward the production of much more highly finished articles, which of course require a larger amount of labor than the more elementary products.

This table is intended to give only a general idea of the remarkable increases in productive efficiency which have taken place in the steel industry in the past 40 years. The data presented are only approximate, and in the steel works and rolling mills particularly they embrace such diversified products that exact conclusions based upon the figures should not be made. The increases referred to can be more accurately analyzed and their significance better understood by studying the several departments separately. This is done in the succeeding sections of this chapter. It is desirable, however, to anticipate the results of such studies to the extent of emphasizing the fact that while the increase in the productive efficiency of employees has been tremendous, the methods of production and the machines and appliances used have been so completely revolutionized during the period under consideration that in the majority of cases the physical and mental effort necessary to obtain the result has actually been lessened. Any assumption, therefore, that increases in the amount of product per employee mean equal increases in the amount of human energy expended are likely to be erroneous and should be made with the greatest caution, only after a complete analysis of the methods by which these increases have been obtained.

AVERAGE NUMBER OF EMPLOYEES, PRODUCTION, AND AVERAGE AND RELATIVE OUTPUT PER EMPLOYEE IN BLAST FURNACES, AND IN STEEL WORKS AND ROLLING MILLS IN SPECIFIED YEARS, 1869 TO 1909.

[Compiled from Special Reports of Census Office, Manufactures, 1905, Part IV, and from Preliminary Report on Iron and Steel for 1909, issued by the Census Bureau, August 25, 1911.]

Items.	1869	1879	1889	1899	1904	1909
BLAST FURNACES.						
Total employees (average number)	27,554	41,695	34,483	41,121	37,414	43,013
Pig-iron production (gross tons)	1,833,000	3,376,000	8,845,000	14,452,000	16,628,000	25,652,000
Average annual output per employee (gross tons)	66.5	81.0	256.5	351.5	444.4	596.4
Relative output per employee (1869=100)	100	122	386	529	668	897
STEEL WORKS AND ROLLING MILLS.						
Total employees (average number)	47,099	96,164	140,537	190,703	221,892	260,128
Production of finished products (gross tons)	1,332,000	3,046,000	7,388,000	15,056,000	18,217,000	26,639,000
Average annual output per employee (gross tons)	28.3	31.7	52.6	78.9	82.1	102.4
Relative output (1869=100)	100	112	186	279	290	362

In spite of the fact that the human effort required has decreased, there is the strongest reason for making a careful examination of the actual severity of the work done in the iron and steel industry at the present time. Such an examination must be made largely by the comparative method. It is almost impossible to convey in any way a satisfactory conception of the absolute amount and severity of the work done in any particular branch of the industry, for not only are exact observations and measurements lacking, but there are no satisfactory terms in which such data might be expressed. It is possible, however, to show how conditions at the present time compare with those which formerly existed in the industry, and also through the published comments of foreign visitors on American industry to show how the work as done in America compares with that in other countries. Data for such comparisons exist. Several of the large companies have furnished complete records of production, extending over a long period of years, during which there have been great advances in production, and the frequent visits of English and German manufacturers have resulted in the publication of the impressions of competent judges concerning the comparative severity of the work in the United States and in Europe. These impressions are particularly valuable, because all of these visitors, struck by the great productive capacity of American works, were interested in inquiring as to the effect of the work on the employees.

In considering the impressions of the British manufacturers it is highly important that the period at which they were made should be taken into consideration, because, as will be shown later, the working conditions in the American steel industry were so completely revolutionized between 1890 and 1900 that the character and severity of the work were entirely altered, while, on the other hand, the English steel works were not greatly changed during the same period. Therefore, between the beginning and end of this decade a complete change is found in the views of the visitors with regard to the character and severity of the work done in the American steel industry.

In 1890, when the British Iron and Steel Institute first held its annual meeting in the United States, comments were made by nearly all of the visitors with regard to the great severity which American methods of manufacture imposed upon its workmen. For example, one of the speakers before the institute in 1890 commented as follows:

> On this point a prominent English steel maker wrote to me recently, after a visit he had paid to several of your leading works: "Of course the output was very large from each pit, and this was attained by great facilities for bringing up and getting away materials, and keeping everything at high pressure. The men, I dare say, are paid well, but it was hot weather when I was there, and they were certainly selling their lives."[1]

This remark applies only to the Bessemer department, but the following statement covering in a general way those in other departments was made[2] as a result of the same visit:

> The "bosses" drive the men to an extent that the employers would never dream of attempting in this country. There are trade-unions,[3] but they do not seem to be able to protect the men in this respect. The bosses have the faculty of driving the men and getting the maximum work out of them, and the men do not seem to have the inclination or the power to resist the pressure.

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[1] James Dredge, in Holley memorial address, Journal of the Iron and Steel Institute, No. II, 1890, p. 380.

[2] James Kitson, in Contemporary Review, vol. 59, p. 629.

[3] At this time there were unions in several steel mills.

Numerous other impressions on this subject might be quoted, but they are uniformly of the same general tenor and may be accepted as the opinions of men thoroughly competent to judge the situation.

In 1902 a special commission was appointed by the British Iron Trade Commission to visit the American steel works and to report upon all industrial phases. The technical study of the industry was subdivided so that each student should be an expert in the particular field to which he was assigned. The impressions of these observers, published in a special report,[1] not only throw a great deal of light on the tremendous revolution in working conditions which occurred between 1890 and 1900, but also give a clear conception of the relative speed and severity of the work in the United States as compared with England. An analysis of the impressions of these men is as follows:

(1) That machines, furnaces, and productive equipment generally are driven harder in America than in England, and that the intensity of the work and the amount of attention required are, therefore, much greater than in the latter country; but

(2) In all departments, owing to the introduction of mechanical devices and improved processes, the manual labor required and the general severity of the work is much less than in England; and

(3) Owing to the use of larger and roomier buildings and the elimination of many of the worst sources of heat, the work is done under less exhausting conditions in the United States than in England.

This applies to every department of the industry except perhaps the Bessemer department, in regard to which no specific reference is made by any of the English observers. In the Bessemer department it is believed that American conditions are at least as good as in England, for while the amount of product handled per man in the United States was in 1901 nearly six times as great as in England, the work in practically all of the English converting plants was done under conditions which had been largely eliminated in the United States between 1890 and 1900. A great many of the English Bessemer plants in 1902 still used cupolas for melting down most of the iron used in their converters, and also cast the steel in pits, methods which, as will be more fully explained later on, constitute extremely exhausting and inefficient working conditions. The opinion of the various English observers is given in detail in connection with each of the departments to which their remarks apply.

It should not be understood from the above mention of improvements that the steel industry does not require hard and exhausting labor. As a matter of fact, it is characterized by much of the hardest and most exhausting toil known in the entire field of industry. It is important, however, to understand that in general an improving situation is being dealt with and one which, in many respects, is superior to that in foreign countries.

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[1] American Industrial Conditions and Competition. Report of British Iron Trade Association Commission, 1902.

BLAST-FURNACE DEPARTMENT.

INCREASES IN PRODUCTIVE EFFICIENCY.

As has been pointed out in the preceding section, the increase during the past 40 years in the productive efficiency of the employees connected with blast furnaces has been very great. This increase has been almost altogether the result of the introduction of mechanical appliances for handling the materials and products of the furnaces, the improvements in the type of the furnaces, and the advancement of metallurgical knowledge. Almost without exception the changes in the equipment and the method of operation have greatly lessened the amount of severe and exhausting labor required in this department.

In order to show in a clear and accurate manner the increase in productive efficiency that has taken place in the blast-furnace department, the data as to production have been compiled for one of the largest plants in the country covering year by year the period from 1890 to 1910. This plant during the entire period has been unusually efficient, not only as regards output, but as regards the economy of fuel and labor. The data referred to are shown in the following table:

AVERAGE NUMBER OF EMPLOYEES, DAYS IN OPERATION, PRODUCTION, AND AVERAGE AND RELATIVE OUTPUT PER EMPLOYEE PER DAY IN THE BLAST FURNACES OF A LARGE STEEL PLANT, 1890 TO 1910.

Years.	Average number of employees.	Days in operation.	Tons produced.	Average output per man per day (tons).	Relative output per man per day (1910=100).
1910	918	275	1,455,706	5.8	100
1909	858	285	1,375,431	5.6	97
1908	709	198	864,876	6.2	107
1907	876	328	1,371,771	4.8	83
1906	940	331	1,232,772	4.0	69
1905	902	333	1,192.693	4.0	69
1904	905	288	1,035,287	4.0	69
1903	1,056	281	999.623	3.4	59
1902	1,245	355	1,080.799	2.4	41
1901	1,022	351	949,880	2.6	45
1900	975	356	823,539	2.4	41
1899	985	365	873.065	2.4	41
1898	1,000	354	811,851	2.3	40
1897	929	315	771,394	2.6	45
1896	812	252	583,176	2.8	48
1895	1,013	284	643.645	2.2	38
1894	763	209	466,375	2.9	50
1893	749	144	297,972	2.8	48
1892	833	277	550,767	2.4	41
1891	812	275	368,725	1.7	29
1890	507	273	250,594	1.8	31

For each man employed in connection with the blast furnaces in 1910 the average daily output was 5.8 tons, as compared with 2.4 tons in 1900 and 1.8 tons in 1890. The output in 1890 per man per day was only 31 per cent of what it was in 1910, and the output in 1900 was only 41 per cent of the 1910 output. In other words, during a single decade (1900–1910) the average output per man per day in this particular plant more than doubled. The increase, it may be noted, occurred almost altogether during the period from 1903 to 1908, the output per man in 1894 having been larger than in any later year up to 1903.[1]

These remarkable results have been achieved only by the most radical changes, both in the equipment and in the methods of operation. The principal changes have been as follows:

(1) Improvements in design and construction of blast furnaces, resulting in a more effective combustion of fuel, thus giving a greater output per unit of cubic contents of the furnaces. These improvements have also greatly increased the life of the furnace lining and have much reduced the amount of time lost due to irregular working and minor repairs. Each of these results has, of course, reduced the number of men required either in the repair department or in the operating force, and by giving more continuous operation has increased the amount of product per employee.

(2) The use of a hotter and more powerful blast, secured mainly through improvements in stove and engine construction, and resulting in a more rapid combustion of fuel and consequent increases in productive capacity.

(3) The utilization of the waste gases of the furnace for the generation of steam. In generating steam with gas only a very small force is required in the boiler house.

(4) The improvement of power generating apparatus, and, particularly during recent years, in the use of gas engines driven by waste furnace gases, thus eliminating the entire boiler-house force and employing merely a small force in connection with gas washers.

(5) The enlargement of the furnaces themselves, cutting down the loss of heat through radiation. The larger furnaces require larger stoves and engines, which, however, do not necessitate any appreciable increase in the number of men required to operate them.

(6) Improvements in the methods of handling materials and products.

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[1] The variations which occurred from year to year were in large part due to local conditions and to the general character of the market for pig iron. For example, if the relining of a large number of blast furnaces happened to fall in the same year the output per employee for that year would be greatly decreased, while if a year of particularly great demand should follow such a year of complete relining and repairs the productive efficiency would be abnormally high.

The last mentioned of these six changes—improved methods of handling materials and products—has been responsible for the greatest increase in the productive efficiency of the employees. Moreover, it is possible to ascertain with almost absolute precision the increase in efficiency which has resulted from the introduction of each of the improved methods. Three of the most important of these new methods of handling materials and products are (1) mechanical appliances for unloading and stocking materials, (2) mechanical methods of charging materials, and (3) methods of handling the products. An analysis of these methods follows:

MECHANICAL APPLIANCES FOR UNLOADING AND STOCKING MATERIALS.

At the docks the increases in productive efficiency have been particularly great, as is shown in the following table, which has been compiled from the records of one of the large plants:

AVERAGE NUMBER OF EMPLOYEES DAYS IN OPERATION, TONS HANDLED, AND AVERAGE AND RELATIVE OUTPUTS PER EMPLOYEE PER DAY AT DOCKS OF A LARGE STEEL PLANT, 1900 TO 1910.

Years.	Average number of employees.	Days in operation.	Tons handled.	Average output per man per day (tons).	Relative output per man per day (1910=100).
1910	109	214	3,825,963	164.0	100
1909	110	214	3,240,013	137.6	84
1908	117	184	2,493,557	115.8	71
1907	179	234	3,611,180	86.2	53
1906	306	214	3,420,957	52.4	32
1905	397	183	2,666,933	36.7	22
1904	407	229	2,179,714	23.4	14
1903	417	244	2,738,905	26.9	16
1902	442	261	2,940,180	25.5	16
1901	680	214	1,918,160	13.2	8
1900	770	229	2,013,511	11.4	7

From this table it will be seen that in 1901, 680 men were required to handle 1,918,160 tons of ore, or, in round numbers, 13 tons per man per day. In 1910, during the same number of days, 109 men handled 3,825,963 tons of ore, or 164 tons per man per day. In 1910, therefore, the productive efficiency of each man connected with the docks was more than 12 times as great as in 1901. In this department at the same time the severity of the work was greatly lessened. During the earlier period it was necessary for a large number of men to work in the holds of the vessels in a cloud of dust shoveling the dusty ores into the buckets by which it was hoisted out. At present men are required in the hold only in finishing up the unloading of the vessel in order to clean out the corners where it is impossible for the large grab buckets to be worked. This result has been secured by wonderful improvements in the machinery for scooping up the material and hoisting it from the vessel and by almost equally great improvements in the design of the vessels themselves, which at present allow the hoist operator to remove the ores from almost every part of the vessel without the aid of auxiliary helpers.

Similar gains have been made in handling the cars of ore at inland plants. At present two men operating a car dumper, which has been previously described (p. 45), can unload as many cars as 12 men working with the most improved type of cars on trestles, or as 40 or 50 men unloading the cars by hand with shovels and forks. The car dumper can maintain an average working speed of 700 to 800 tons per hour, unloading during that time 15 cars and can, under pressure, handle as many as thirty 50-ton cars per hour. Similarly great improvements have been made in transferring the materials from the stock piles to the storage bins. A modern bridge conveyor or ore bridge, having a capacity of 12 cars per hour, manned by only two men, and with the assistance of one switching locomotive manned by two men, can handle 9,000 tons per day. If this work were done by hand, it would require from twenty to thirty times as many men.

Together with the great increases in productive efficiency in this department there has been a decrease in the amount of hard manual labor required. Not only was the stocking of materials heavy work, but it was done entirely out of doors and much of it under the severest weather conditions.

MECHANICAL METHODS OF CHARGING MATERIALS.

An equally great change has taken place through the introduction of mechanical methods of charging materials into the furnaces. This change has involved the use of electrically-driven larry cars and inclined skip hoists with automatic dumping and distributing apparatus. An almost exact analysis of the effects of this change on the efficiency of the workmen can be given.

In 1887, in one of the large plants, 82 men were required to charge the materials necessary to produce 350 tons of pig iron per day, which is equivalent to 4.27 tons per man per day. As approximately 3.8 tons of materials are required for each ton of iron, each man handled an average of 16.2 tons per day. This force includes the bottom fillers, top fillers, and cagers. In the same plant in 1902, through the use of larger barrows for handling the materials at the bottom of the furnaces and improvements in the hoisting mechanism, 373 men handled the materials for 3,045 tons of pig iron per day, which is equivalent to 8.16 tons per man. Thus, at the rate of 3.8 tons of materials for each ton of pig iron, each man handled an average of 31 tons of materials per day. In 1910, through the introduction of electrically operated scale cars which automatically weigh the ore, and by the construction of inclined skip hoists at all furnaces, 104 men handled the materials for 5,293 tons of pig iron per day, or

50.9 tons per man. This was the equivalent of an average of 193 tons of materials per man per day, or twelve times as much as in 1887. Viewing the matter from another standpoint, if the materials had been handled in 1910 by the methods used in 1887, 1,250 men would have been required at these furnaces simply to charge the materials into the furnaces, whereas the total operating force for these furnaces in 1910 was only 900.

The work of the bottom fillers was very hard manual labor, and was done for the most part in the open under all sorts of weather conditions. The top fillers, who have also been eliminated by the introduction of improved methods of charging the furnaces, performed one of the most disagreeable and at the same time one of the most hazardous tasks in connection with the entire industry.

METHODS OF HANDLING THE PRODUCTS.

The change in the methods of handling the products of the furnaces has been as revolutionary and almost as productive of efficiency as those described in connection with the handling of materials. This change has consisted principally in carrying the hot metal directly in ladles to the Bessemer or open-hearth department, or, where this is impossible, casting the pig iron in a machine specially built for the purpose and known as the pig-casting machine. By the old methods of working the pig iron is first cast in sand beds on the floor of the furnace and afterwards broken up and carried away by hand. In a plant casting all its pig iron in sand beds a crew of 35 men is required to handle the product of a furnace turning out 175 tons per day, or an average of 5 tons per man per day. To handle the product of 5 furnaces of 500 tons by such methods would require 500 men, whereas the number of men actually required in a plant of this size for the complete disposition of 2,500 tons of product by the use of ladles and pig machines, including in both cases the entire casting crew, is approximately 130. Each man by this method, therefore, handles an average of about 20 tons per day. In other words, the efficiency of the workmen using modern methods of casting and moving the metal is about four times as great as under the older methods. As has already been pointed out, the work in this division of pig-iron production, while it is still extremely severe and exhausting, has been lightened by the introduction of modern methods.

Among other factors which have served to increase both the efficiency of the workmen and at the same time to lighten the work may be mentioned the use of the mud gun, the pneumatic drill, and the introduction of modern methods of slag disposal through the use of slag ladles and granulating pits.

Readers who wish more detailed information as to the comparative conditions of work in this department in 1895 and at the present time are referred to Appendix F, page 522. A full account is there given of the work in each occupation in 1895, together with brief notes of the more important changes up to 1910. The description relates to the conditions existing in an important plant in 1895 and was prepared for this report by a practical steel man who was a superintendent in the plant at that time.

CHAPTER XIV.

RELATION OF UNSTEADY EMPLOYMENT, LOW WAGES, LONG HOURS AND NIGHT WORK TO PRODUCTIVE EFFICIENCY.

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RELATION OF UNSTEADY EMPLOYMENT, LOW WAGES, LONG HOURS, AND NIGHT WORK TO PRODUCTIVE EFFICIENCY.

In the preceding chapters the discussion of productive efficiency has been directed almost entirely to what may be called operating conditions. In many cases it has been possible to trace almost exactly the effect of various improvements in operating conditions on the productive efficiency of the workmen. There are, however, a number of additional factors of considerable if not equal importance which are matters of general policy, with regard to which accurate data are not yet available. Some discussion of these factors, however, is given at this point in order to indicate in a general way their very great significance and in the hope that by directing attention to them data may be accumulated upon the basis of which really accurate conclusions can be drawn.

UNSTEADY EMPLOYMENT AND SHIFTING CHARACTER OF THE LABOR FORCE.

In order to secure a high degree of efficiency on the part of any class of workmen it is obviously desirable that there should be as few idle periods as possible, for during such periods of idleness the workmen undergo considerable loss of skill. These idle periods result from two principal causes: (1) Great fluctuations in the industry itself and (2) the shifting character of the labor force.

It has long been a policy of many of the leading steel manufacturers to run their plants at maximum capacity while the orders were large and then shut the mill down entirely until the market has sufficiently improved to give another large order. This policy is recognized as "good American practice" throughout the industry and is in complete contrast to the custom of most of the European manufacturers. This general question is discussed in full in Chapter VII (pp. 205 to 214), but some comment on its relation to efficiency is desirable here. Certain economies, of course, are secured through this policy. The most important of these economies consist in the fact that the men who are paid on time rates are necessarily paid the same whether the mill is running at full capacity or at considerably below full capacity. When the mill is shut down the wages of these men are saved. The saving from this source, together with certain minor economies, unquestionably results in giving a very low labor cost and general cost of production for the period during which the mill is operated. Nevertheless, the capital charges and other fixed costs which form so large a part of the cost of producing steel necessarily go on when the mill is shut down. Furthermore, there must inevitably be a great loss of skill on the part of the men during any shutdown which lasts more than a few days. This was pointed out in an address before the British Iron and Steel Institute. In this address the speaker describes the remarkable results which had just been secured in the Edgar Thompson Steel Works, of which he was then superintendent. After describing the general plan of the works he introduced the description of the record-making run as follows:

> For the first month we find the men are out of practice. It is not a little singular that a few weeks' stoppage will make the men rusty and almost awkward; and my experience has been that after a stoppage for repairs, it generally requires from four to six weeks before the workmen again recover the skill and energy displayed before the works were stopped.[1]

In Chapter VII, which deals with the irregularity of employment in the steel industry, some understanding of the tremendous fluctuations characteristic of the steel industry is given. This feature of the industry is so fully discussed at that point that any further discussion of it here is unnecessary.

Besides the fluctuations due to industrial conditions, there is also much unsteady employment due to the fact that many of the men do not retain any one position for a very long period, but go from plant to plant and take whatever work they can secure wherever it is offered. This characteristic of many of the steel workers unquestionably grows out of the unsteady industrial conditions which have been pointed out above. Many of the men leave on the slightest rumor of shutdown in the hope of obtaining work elsewhere before really serious trouble has come. From whatever cause this unsteadiness may arise, it is a matter which should receive the most careful consideration from the steel manufacturers. Through the records of the mutual benefit association of one of the large steel plants, in which practically all employees of the company are members, some insight as to the degree of the shifting of the labor force can be obtained. The data for each of the years 1905 to 1910 are shown in the following table.

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[1] Address of Capt. William R. Jones, Journal of the Iron and Steel Institute, vol. 1, 1881, p. 130.

SHIFTING OF LABOR FORCE IN A LARGE STEEL PLANT, 1905 TO 1910.

	1905	1906	1907	1908	1909	1910
Employees, Jan. 1	11,631	15,661	16,608	13,578	13,731	16,997
New employees during year	14,023	13,983	11,705	4,169	10,792	13,043
Total	25,654	29,644	28,313	17,747	24,523	30,040
Employees, Dec. 31	15,661	16,608	13,578	13,731	16,997	15,510
Employees deceased during year	119	127	165	109	139	156
Loss of employees due to leaving plant and not returning during year	9,874	12,909	14,570	3,907	7,387	14,374
Per cent of total employees leaving plant and not returning during year	38	44	51	22	30	48
Employees leaving work but reemployed during year	6,649	6,733	6,689	6,934	8,162	6,135
Per cent of total employees temporarily leaving work	26	23	24	39	33	20

The situation due to unsteady work is peculiarly important in the South, where the large Negro population makes it necessary in many cases for the superintendents to carry on their rolls a force of men from 50 to 100 per cent larger than is necessary to operate the mill on any particular day. Records available for the month of January, 1910, show that in one blast furnace plant it was necessary to have 942 men on the rolls in order to perform the work which required an average of 527 men. The number of men on the pay roll was, therefore, 79 per cent more than the actual number required at one time. In another blast furnace plant the proportion on the pay roll during the month was 51 per cent higher than the total number necessary to operate the plant on any given day. In a large and well-organized steel works 5,917 men were employed during the month. The average number of men required to operate this plant was 3,764. During this month, therefore, it was necessary to have 57 per cent more men on the pay rolls than were needed at any one time. This was during a period of large production, and there were almost exactly as many men required at the end of the month as at the beginning. Nevertheless, 1,647 men left the employ of the company during the month, while from day to day it was necessary to count on 12 per cent of the total force being absent from duty. The facts are shown in detail for these plants in the table which follows:

PER CENT OF MEN NECESSARY TO EMPLOY TO MAINTAIN AVERAGE WORKING SCHEDULE AND PER CENT OF ABSENTEES OF THOSE ENROLLED, FOR CERTAIN SOUTHERN PLANTS, JANUARY, 1910.

	Blast furnaces.		Steel works.	Rolling mills.
	Plant A.	Plant B.		
Number of men on roll Jan. 1	680	247	4,279	523
Employed during month	262	120	1,638	88
Total	942	367	5,917	611
Left service (all causes)	241	129	1,647	76
On roll 1st of next month	701	238	4,270	535
Average number of men on roll	691	291	4,274	529
Average number of men at work	527	243	3,764	442
Average number of absentees	164	48	510	87
Per cent of absentees	23.7	16.5	11.9	15.9
Per cent of average on roll to obtain 100 per cent service	131.1	119.8	113.5	119.7
Per cent of total enrolled necessary to obtain 100 per cent service	178.7	151.0	157.2	138.2

LOW WAGES AND INEFFICIENCY.

The payment of low wages, or rather the existence of a cheap labor supply, affects efficiency in two ways. In the first place, the workmen who can be hired at a low rate of wages are generally very inefficient in comparison to more highly paid men, not only because they actually perform less work than more highly paid workmen, but because a larger amount of supervision is necessary. Second, cheap labor is also responsible for inefficiency, because low wages usually hinder the installation of mechanical aids which increase human efficiency, and also because cheap labor generally tends to promote lax management. The effect of low wages in hindering the installation of the best mechanical equipment is the point to which attention is particularly directed here. The relation of cheap labor to low-grade equipment is strikingly shown in a recent description of the large blast furnaces erected within the last few years at Hanyang, China.[1] In these furnaces all of the materials and products are handled by hand, because the coolie labor is so cheap that it would not be economical to spend a large amount of money necessary to provide really efficient equipment.

The effect of cheap labor in retarding the use of improved methods is also strikingly seen in the figures showing the cost of production of various iron and steel products in northern and southern plants recently published by the Bureau of Corporations. In the northern furnaces the average labor cost per ton for basic pig iron (1902 to 1906) was 62 cents, while the labor cost per ton for southern iron was $1.23, or practically double the northern cost.[2] In 1910 the average wage for blast-furnace employees in the North was 18.5 cents and in the South 13.8 cents, or approximately 25 per cent lower than in the North.[3] The report of the Commissioner of Corporations in commenting upon this difference attributes a part of this higher labor cost to the use of low-grade ore which requires a greater amount of materials per ton of product, but also mentions as other factors the smaller and less efficient furnaces and lower efficiency of labor.[4] The reports of the Commissioner of Corporations show that approximately 34 per cent more material was charged into the furnaces. This is obviously not enough to account for a labor cost which is twice as high as the northern cost when the wages are themselves approximately 25 per cent less than in the North. The greater difference seems unquestionably to be due to inefficient work on the part of the southern labor and even more to the fact that the cheapness of southern labor has hindered the installation of efficient equipment. Of the 53 southern blast furnaces for which schedules were secured in this investigation 34, or approximately 64 per cent, were filled by hand, while in the North out of 182 blast furnaces for which data were secured only 45, or about 25 per cent, were hand filled. The proportion of furnaces operated with the old equipment was, therefore, two and one-half times as great in the South as in the North.

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[1] Iron Trade Review, July 7, 1910, p. 23.

[2] Report of the Commissioner of Corporations on the Steel Industry, Pt. II, Preliminary Report, Jan. 22, 1912, p. 21.

[3] See Vol. I of this report, p. 38.

[4] Report of the Commissioner of Corporations on the Steel Industry, Pt. II, Preliminary Report, Jan. 22, 1912, p. 23.

RELATION OF LONG HOURS AND NIGHT WORK TO EFFICIENCY.

Very little data of a positive nature could be secured bearing on the relation of the long hours and night work, characteristic of the steel industry, to the efficiency of the workmen. Nevertheless, a few important facts and statements were secured which throw a great deal of light on the subject in question.

With regard to the effects of seven-day work on the efficiency of the workmen very little direct evidence could be obtained except in one case. In one plant the records for ore unloading day by day are available over a long period of years. The records for the earlier years in which the ore was handled on every day in the week show practically a dead level throughout the week, no one day being appreciably higher in the amount of ore handled than any other. During 1910 no ore was stocked on Sundays. The records for this year show that 7 per cent more ore was unloaded on Monday than the average for the remaining five days of the week. The foreman of this plant stated that the men are fresher and do more work on Monday after a full day of rest on Sunday than on any other day of the week.

With regard to the effect of night work on the efficiency of the workmen it has generally been believed by practical steel men that the men on the night crew were more efficient than the men on the day crew, because a larger output was obtained on the night shift than on the day shift. As a matter of fact, this is not really an accurate comparison, because most of the repair work which inevitably interferes somewhat with the operations of the department is uniformly done on the day shift, and, furthermore, it is usually the duty of the men on the day turn to see that all necessary materials required for the night shift are obtained during the day. It is a matter of common observation on the part of both the men and the superintendents that the men who work at night are very much more apt to be tired and out of condition when they come to work. In a letter received from one of the large steel companies during the present investigation this matter is stated as follows:

> The theory of the superintendents is that men working on the night turn do not sleep so well as men working on the day turn, and they are not so fit for service immediately after coming on duty.

During the past year a great deal of interest has been awakened among the more progressive steel manufacturers as to the effect of the long working hours on efficiency, and in letters received from a number of these manufacturers with regard to the introduction of plans for securing six-day work many of them express a strong belief that the introduction of six-day work for all men employed in the plant will greatly increase the efficiency. This belief is generally based on the following considerations: (1) That the day of rest regularly secured each week will give a much fresher and consequently more efficient force; (2) that since the operation of the various plans for securing six-day work requires the constant interchange of men in various occupations the men will quickly become familiar with a much wider range of work and consequently will perform their regular work much more efficiently; (3) that it will be possible to secure men of higher average intelligence and ability when they are obliged to work only six days a week. Many superintendents have noted a gradual decrease in the general intelligence of the workmen, which they attribute to the fact that first-class men will not accept the seven-day work formerly required in the blast furnaces throughout the industry, but will go into other occupations or industries in order to avoid it.

CHAPTER XV.

TIME AND METHOD OF WAGE PAYMENTS.

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INTRODUCTION.

The frequency with which wages are paid and the form in which such payments are made are of such significance to the employee that under certain conditions these features of the payment of wages become even more important than the wage itself. If wages are paid at very long intervals, the average workman is compelled, through his lack of ready money, either to trade at the company store or to open an account with some outside merchant, and in this way to accumulate debts from which he can free himself only with the greatest difficulty. Thus he not only loses the economic advantage of making cash payments, but also finds his independence and freedom of action considerably restricted. Furthermore, where it is the custom for the company to deduct from the wages of the employees for services which are furnished freely by other employers or which are in many cases guaranteed by the law, the discrepancy between the nominal wages and the actual value of such wages becomes even greater.

Modifications of the actual value of wages, resulting from such causes as those mentioned, are of evident importance in a study of wages. The character of these modifications, however, is such that it is impracticable to consider them in a statistical presentation of wage rates or earnings. The only practical method is to discuss such modifications in a descriptive manner and show their approximate effect on real wages by means of typical cases. This is done in the remaining pages of this chapter.

FREQUENCY OF WAGE PAYMENT.

The frequency with which wages are paid is a matter of serious importance to the workmen—in the first place, because there is a definite convenience in having wages paid at short and regular intervals; in the second place, because where the length of time elapsing between the beginning of his employment and the first settlement of wages is very long it is almost unavoidable for him either to become indebted to private merchants or to trade at the company store and in the latter case accept, instead of the full value of his wages, store orders, for which no one will pay the face value. Such a result is indeed almost inevitable where more than two weeks elapse between the time of beginning employment and the time of receiving the first settlement of wages, for it is only the exceptional workman who on accepting a new position has sufficient funds to pay cash for all that is bought during a period even so short as two weeks.

The immediate interest of the employer is to have pay days as infrequently as possible, not only because by this means a great deal of bookkeeping may be eliminated, but because during the entire period that wages are unpaid after they have been earned the employer is virtually receiving interest on the full amount of such wages. Where a company store is operated, the interest of the employer is even stronger in having pay days come as infrequently as possible. This is clearly shown in the case of one small blast furnace company, which changed its pay rolls from a weekly to a monthly basis. When the men were paid weekly, the amount of store orders per month was $400, or 10 per cent of the total pay roll. Immediately after the change the store orders increased to $1,200 per month, or approximately 30 per cent of the pay roll. A competing store lost practically all of what had been a good business before the change in the pay day was made. It is also significant that most of the companies operating stores are found to pay wages monthly and to delay the actual payment of wages as long as possible after the end of the pay-roll period.

The following table shows by districts the frequency of wage payments in the different iron and steel establishments throughout the country:

NUMBER OF PLANTS AND NUMBER AND PER CENT OF EMPLOYEES HAVING WAGES PAID AT SPECIFIED PERIODS.

District.	Wages paid weekly.			Wages paid bi-weekly.			Wages paid semi-monthly.			Wages paid monthly.		
	Number of plants.	Employees.		Number of plants.	Employees.		Number of plants.	Employees.		Number of plants.	Employees.	
		Number.	Per cent.		Number.	Per cent.		Number.	Per cent.		Number.	Per cent.
New England	17	5,664	90.84	3	407	6.53	1	116	1.86	1	48	0.77
Eastern	35	14,717	37.49	31	8,725	22.22	33	15,312	39.00	3	506	1.29
Pittsburgh	3	322	.31	8	7,179	7.00	106	95,113	92.69	......	......	......
Great Lakes and Middle West	23	4,522	6.55	11	2,471	3.58	75	61,602	89.19	5	470	.68
Southern	5	1,088	8.00	6	1,449	10.65	11	6,098	44.83	31	4,967	36.52
Pacific Coast	1	118	23.09	2	186	36.40	1	207	40.51	......	......	......
Total	84	26,431	11.43	61	20,417	8.83	227	178,448	77.15	40	5,991	2.59

By far the largest number of employees in the iron and steel industry were paid semimonthly, 227 plants, with 178,448 employees (77 per cent of the total number of employees in the industry), paying on this basis. In addition, 61 plants, having a total of 20,417 employees, or 8.8 per cent of the total number, paid biweekly. Wages were paid weekly in 84 plants, with 26,431 employees, or 11.4 per cent of the total number. In all, therefore, 97.4 per cent of the employees in the industry were paid semimonthly or oftener. On the other hand, there were 40 plants, 31 of which were located in the Southern district, which paid wages only once a month. These plants were for the most part small, as is shown by the fact that the 40 plants had a total of only 5,991 employees.

There is the most striking differences as regards time of wage payment among the different districts. In the New England district approximately 91 per cent of the employees were paid weekly, while in the Southern district approximately 37 per cent were paid monthly. In the two large districts, the Pittsburgh and the Great Lakes and Middle West districts, practically 90 per cent of the employees were paid semimonthly.

With few exceptions wages were never paid on the last day of the pay-roll period, but some time afterwards, in order to allow time for the statement to be made up and to give an opportunity for all necessary adjustments to be made. Where the time elapsing between the end of the pay-roll period and the actual day for paying wages is only a matter of two or three days it is of little consequence, but in many of the cases investigated the time allowed to elapse before the workmen were paid was so long that they were seriously affected by the delay. It is interesting to note that the time allowed for making up the pay rolls after the end of the pay-roll period varied almost in direct proportion to the frequency with which wages were paid. For example, where wages were paid weekly only 3 or 4 days were usually allowed for making up the pay roll. In case of semimonthly payments usually from 8 to 11 days elapsed before pay day, while in the case of monthly payments from 10 days to a full month was usually allowed to pass before settlement was made after the close of the actual period for which wages were paid.

In order to bring out clearly the length of time intervening between the beginning of the pay-roll period and the day on which the settlement of wages was actually made the following table has been prepared. The elapsed time shown in this table is calculated by taking the number of days in the pay-roll period and adding to this the average number of days which was ordinarily allowed for making up the pay roll. For example, in the case of semimonthly pay rolls the total elapsed time may be 15 days plus 9 days, the latter number representing the average time allowed for making up the pay roll.

LENGTH OF TIME BETWEEN BEGINNING OF PAY-ROLL PERIOD AND TIME SETTLEMENT OF WAGES IS ACTUALLY MADE, BY DISTRICTS.

Number of days elapsing between first day of pay-roll period and actual pay day.	New England.			Eastern.			Pittsburgh.			Great Lakes and Middle West.		
	Number of plants.	Employees.		Number of plants.	Employees.		Number of plants.	Employees.		Number of plants.	Employees.	
		Number.	Per cent.		Number.	Per cent.		Number.	Per cent.		Number.	Per cent.
Under 10	2	93	1.49	8	1,556	3.96	......	......	......	7	525	0.76
10 and under 15	15	5,571	89.35	25	12,555	31.98	3	322	0.31	16	3,564	5.16
15 and under 20	1	150	2.41	3	391	.49	3	1,163	1.13	13	1,919	2.78
20 and under 25	3	373	5.98	33	10,441	26.59	35	31,964	31.15	30	29,516	42.74
25 and under 30	......	......	......	24	12,743	32.46	69	67,459	65.74	34	22,957	33.24
30 and under 35	......	......	......	5	699	1.78	7	1,706	1.66	9	9,842	14.25
35 and under 40	......	......	......	3	722	1.84	......	......	......	1	322	.47
40 and under 50	1	48	.77	1	153	.39	......	......	......	4	420	.61
Total	22	6,235	100.00	102	39,260	100.00	117	102,614	100.00	114	69,065	100.00

Number of days elapsing between first day of pay-roll period and actual pay day.	Southern.			Pacific Coast.			All districts.			
	Number of plants.	Employees.		Number of plants.	Employees.		Plants.		Employees.	
		Number.	Per cent.		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Under 10	4	960	7.06	1	118	23.09	22	5.34	3,252	1.41
10 and under 15	1	128	.94	......	......	......	60	14.56	22,140	9.57
15 and under 20	2	414	3.04	......	......	......	22	5.34	4,037	1.75
20 and under 25	12	2,522	18.54	2	324	63.41	115	27.91	75,140	32.49
25 and under 30	2	4,130	30.36	1	69	13.50	130	31.55	107,358	46.42
30 and under 35	2	641	4.71	......	......	......	23	5.58	12,888	5.57
35 and under 40	5	477	3.51	......	......	......	9	2.18	1,521	.66
40 and under 50	17	3,072	22.58	......	......	......	23	5.58	3,698	1.60
50 and over	8	1,258	9.25	......	......	......	8	1.94	1,258	.54
Total	53	13,602	100.00	4	511	100.00	412	100.00	231,287	100.00

From the above table it will be seen that in the case of more than one-half of the 231,000 employees, 25 or more days elapsed between the first day of the pay-roll period and the day upon which the settlement of wages was actually made. This means that when an employee accepts a position he must be able to support himself out of his own funds for a period of very nearly a month or else incur debt either at the company store or with some private merchant.

In the Southern district, where company stores are especially prevalent, approximately 70 per cent of the employees were paid under methods which allowed a period of 25 or more days to elapse between the first day of the pay-roll period and the actual pay day. In the New England district, on the other hand, approximately 90 per cent of the employees received their wages within less than 15 days after the beginning of the pay-roll period. In the Eastern district slightly more than one-third of the employees were paid within 15 days after the beginning of the pay-roll period, but another third of the employees in this district were paid only after 25 days had elapsed. In the Pittsburgh district, which is by far the most important district from the standpoint of the number of employees involved, approximately two-thirds of the employees were not paid until 25 or more days after the beginning of the pay-roll period and only 1.4 per cent were paid within 20 days after the beginning of the pay-roll period. Considering the country as a whole, there were 63 establishments employing 19,360 men in which the employees were not paid until 30 days or more after the beginning of the pay-roll period. This latter arrangement was of particular prevalence in the South, where in 32 of the 53 plants the time elapsing between the beginning of the pay-roll period and the actual day of settlement was 30 days or more. In the same district there were 25 plants with 4,330 employees where pay day was 40 days or more after the beginning of the pay-roll period. The effect of such long periods intervening before the payment of wages has already been pointed out and the reason for it is very largely to be found in that most of the plants in which wages are paid monthly operate company stores.

The weekly payment of wages is strongly opposed by a great many manufacturers on the ground that it involves a large amount of bookkeeping, and that in the case of a very large establishment it is impossible to close up the accounts as often as once a week because of the large force which would be required simply to make up pay rolls. While such objections have some weight in connection with the weekly payment of wages, they lose their force when used to justify the payment of wages only once a month. Furthermore, much of the difficulty involved in making up pay rolls for a large establishment at short intervals can be obviated by the use of a system which has been adopted by some of the larger companies. This system consists briefly in having the pay days for different departments come on different days of the week, so that instead of the great rush necessary to pay all departments of a large establishment on a single day the work is equally distributed throughout the week, and some department is being paid every week day. This system has numerous other advantages, among which the following may be noted as the most important ones: (1) A much smaller amount of cash is required for the payment of wages both on any specific day and in total, since much of the cash paid out during the early part of the week returns to the company before the end of the week; (2) by distributing the pay days throughout the week a much smaller force of employees is required to handle the payment of wages; and (3) through the fact that only a comparatively small proportion of the employees receive their money on the same day the temptation to spend a large part of it in saloons is greatly decreased. In the towns where this system has been adopted the habit of drinking on Saturday night is much less noticeable than in most mill towns.

In many of the establishments which nominally pay semimonthly, and which are so shown in the tables above, the actual arrangement is to make 22 fortnightly payments, and in order to complete the year there is in each quarter one payment which extends over a period of three weeks. This system was strongly objected to by many of the workmen on the ground that it made it very difficult to meet their bills, which were presented at the regular time without reference to the frequency with which the company paid its workmen.

ADVANCES ON WAGES.

Where employees are not paid more frequently than once a month it is nearly always necessary for them to make some arrangements to secure cash during the interval with which to make purchases outside of the company store or to make the various other payments which arise. Since these employees have no money to lend each other, and small loans of this character can be secured from the large companies only at exorbitant rates, many methods of securing cash in advance of pay day have been devised. In all of these cases, it should be noted, the employee attempts only to secure what is already due him for work actually performed, but which is not payable until the day set by the company. Several of these methods are discussed below.

CASH CHECKS.

In the case of seven companies located in the Southern district this necessity was made a source of profit to the company. In these seven companies, when the employees asked before pay day for the payment of wages already earned they were given store orders or some form of scrip which could then be cashed at a discount of 20 or 25 per cent either by the company itself or at the company store. These seven companies together employed 2,600 men, and by the practice of such discounting greatly reduced the amount of cash necessary for the payment of wages. In every one of these seven plants wages were paid only once a month, and from 10 to 20 days were allowed in each case for the making up of the pay roll. From 40 to 50 days, therefore, elapsed between the beginning of the pay-roll period and the day on which the settlement of wages was actually made. In none of these cases, it should be noted, is any money advanced which has not already been earned by the employee and which is not on the books to his credit. The transaction, therefore, amounts simply to the deduction of either one-fifth or one-fourth of the total amount of wages for the simple service of paying it before the time set by the employer as the regular pay day. Furthermore, the same charge was made for money advanced two or three days before pay day as for advances made two or three weeks before pay day.

In order to make clear the profits to the company from thus discounting wage advances, the following statement for one company may be given. This company issues both store orders and what are known as "cash checks." The store orders can be exchanged for goods at the company store at full value. The cash checks are the form in which advances on wages are made, and are cashed by the company store at a discount of 20 per cent. Neither the store orders nor the cash checks are transferable, and consequently they are not discounted by other persons. During the fiscal year ending June 30, 1911, the total pay roll for this company amounted to $1,431,425.95. During the same year the company issued cash checks to the amount of $187,743. The profit for the year upon this amount of cash checks at a discount of 20 per cent was $37,548.60.

Some inquiry was made at this plant to find by whom the cash checks were used. It was found that none of the Italian employees, of whom there were a considerable number, made any use of them at all. Their use was chiefly confined to the Negroes, who formed the larger part of the working force. For most of the employees who were in the habit of using the cash checks, the amount checked out by each employee ranged from $10 to $30 per month, which meant a loss of from $2 to $6 to the workman and a profit of equal amount to the company. In this company the workmen were paid monthly, and the pay day did not come until two weeks after the end of the month. It was, therefore, more than 40 days after the beginning of the pay-roll period before any cash could be had except by paying a discount of 20 per cent for it Such large and numerous deductions were made by this company that out of the total nominal pay roll of $1,431,425 only $835,735 was paid in cash. Nearly $600,000 was deducted from the pay of the employees for various items. It may be noted in this connection that this was not a small company operating on limited resources but a plant of one of the largest and most prosperous "independent" steel companies.

PURCHASE AND SALE OF STORE ORDERS.

In the case of other companies in the Southern district employing in total about 4,600 workmen store orders issued as advances on wages were not cashed directly by the company or by the company store, but were bought and sold by outside parties at discounts ranging from 10 to 25 per cent. In many cases the clerks and minor officials of the company made of this a regular and lucrative business.

The business of buying and selling of store orders was found at the time of the investigation to be most prevalent and highly developed in connection with one of the large western steel companies, which operated a large department store. The advances on wages were made by this company in the form of "scrip" orders upon the company store. As the prices at the company store were very reasonable and the goods were of the best quality, these scrip store orders were in great demand if purchasable below par. At the time of the investigation in 1910 this scrip was openly bought and sold by people in all parts of the town, both employees of the company and others. A special business was made of purchasing it by men known as "scrip brokers," who had small offices immediately across from the company store, and who dealt in it openly. At one time there had been as many as seven brokers' offices immediately across from the store. These brokers issued quotations on the scrip, usually at a discount of from 20 to 25 per cent, according to the amount that was offered, and sold it usually at an advance of 5 cents on the dollar. The amount dealt in was very large. In addition, practically all the saloons in the town posted quotations stating the discount at which the scrip would be received "in trade," as well as the cash discount. The saloons, it may be noted, always paid from 5 to 10 cents less on the dollar than did other purchasers. At the time of the investigation the plant had been operating for some time on a reduced schedule, and consequently the amount of scrip issued was relatively small.

The number of brokers at that time was only three, and the scrip was selling at a discount of only 20 per cent. In June, 1911, the store orders of this company were made nontransferable, and as a result the evil mentioned has been to a large extent eliminated.

DEDUCTIONS FROM WAGES.

Deductions from wages for a variety of purposes are made in many plants. The character and extent of such deductions vary greatly, not only in the different districts of the industry but also in different establishments within a district. It was found impracticable in dealing with the subject to treat it from a purely statistical standpoint, as only a relatively small proportion of the plants in the industry could be given the investigation necessary to develop accurate and complete data on this point. For all practical purposes, however, it is sufficient to understand the general nature of such deductions and the extent of their prevalence in the industry. Some of the deductions are of such a character that their existence even in a very small number of establishments is worthy of note, because in all cases they constitute a real grievance of the employees.

DISABLEMENT FUNDS.

In an industry as hazardous as the steel industry a great deal of time is lost and heavy expenses are incurred by the employees through the occurrence of accidental injuries. Some of the more progressive of the steel manufacturers have recognized that the compensation for such accidents is a proper charge against the industry, and have put into effect plans for providing compensation. In contrast with this policy some companies have developed plans by which the employees themselves are made to pay the compensation in case of accident and by which the company is entirely relieved from making any payments except in a few cases of gross negligence, where action may be brought through the courts. Six establishments having in all 2,435 employees were found to have in operation plans for shifting the burden of accident compensation from the company to the employees. These companies were all located in the Southern district, although one of them was a large "independent" corporation with most of its plants in another part of the country.

The plan utilized by these companies to avoid the payment of accident compensation consisted in the deduction from the wages of each employee of a certain sum which was devoted to the establishment of a fund, administered by the company, from which payments were made in case of accidents. The deductions in three of these cases were made monthly and amounted to one-half of one day's wages for each of the employees. In one establishment the deductions were uniformly 50 cents for all classes of employees, while in another case they were graduated from 30 cents per month in the case of employees earning less than $1 per day to 60 cents in the case of employees earning $2 or more per day. In the remaining establishment a uniform deduction of 1 per cent of each employee's earnings during the month was made. In five cases the fund was administered by the officials of the company, who make payments in accordance with a more or less definite plan, the general character of which is shown below. In one case, however, the fund was handled somewhat indirectly through a life insurance company. The working of the system in the last-mentioned establishment can best be understood through the following quotation from the report of the agent who made the investigation:

> The fee deducted for the disablement fund is usually one-half of one day's pay in each month, for which an employee, if injured, is entitled to half wages for a period not to exceed six months. If an injured employee enters a claim for damages he is sent to the agent of the ——— Insurance Co., who acts as agent for the ——— Iron Co., and settlement is effected there. No specified amount is paid for any injury, such as the loss of a hand. The ——— Insurance Co. settles for the least amount possible. The ——— Insurance Co. had a contract with the ——— Iron Co. during the months of February, March, April, and May, and claims were made by 95 employees, who were injured during those months, the last claim counted being filed in October. It is possible others may yet be filed. In the case of one man who was killed on June 28 by falling into a concrete mixer, $500 was paid to his relations.

In the other five companies the general plan of collecting and administering the fund was much the same as that indicated in the following typical announcement:

——— IRON AND STEEL CO.

———, *October 1, 1909.*

To the employees of the ——— Iron & Steel Co.:

Commencing November 1, 1909, this company will establish a system of employees' accident benefit fund at all its mines and plants similar to the system which has been in effect at similar plants and mines in the ——— district, and which has given universal satisfaction to employees. *A small voluntary deduction will be made from the wages of all employees monthly for this purpose.*[1] In the event of accidental injury to or accidental death of an employee from whom this deduction has been made while engaged in his regular work on the premises of the company, he will be entitled to fixed benefits from this fund. The conditions governing this fund, the charges to be paid, and the benefits to accrue are as follows:

WORKMEN'S BENEFIT FUND.

CONDITIONS.

1. Accidental injury while engaged in his regular work on the premises of the company in its service.
2. Charges and benefits will begin on the date of employment and will cease on the date of leaving the employ of the company.
3. No employee shall be entitled to benefits who has not paid all accrued charges.
4. All benefits shall be paid monthly through the pay roll, subject to the rules governing same.
5. The company's physician's certificate must be secured *on the day of accident,*[1] certifying to the disability. Injured persons must see or be seen by the company's physician every day during temporary disability, and said physician must issue a certificate to the company upon sufficient recovery of injured party to resume work. *The company's physician shall also determine whether death is due to accidental injury.*[1]
6. *The certificate of the company's physician* [1] as to the existence and duration of disability *shall be conclusive.*[1]

CHARGES.

1. *One-half day's pay each month pays for benefits for that month.*[1]
2. Where men are working under contract the charges and benefits shall be based on an estimate of an average day's earnings.

BENEFITS.

1. One-half day's pay for each working day during term of temporary disability as certified by company's physician, said term not to exceed six months.
2. The loss of one hand, one foot, or one eye, one-half day's pay for each working day for six months, irrespective of ability to resume work during that time.
3. For loss of both hands, both feet, or both eyes, or a permanent disability, one-half day's pay for each working day for a period of one year.
4. In case of death from accidental injury sustained while engaged in regular work for the company in its service on its premises, one-half day's pay for each working day to the widow, and if no widow to the next of kin of deceased for a period of one year. If a different beneficiary is desired in event of death, written notice must be given by assured.
5. Benefits to be based on rate of pay at the time of injury.

It will be noticed that in the announcement the deduction is described as "voluntary." It is, as a matter of fact, voluntary only in the sense that the employee agrees to it as a condition of securing and retaining a job. On entering the company's service each workman is required to sign an employment slip which has printed across the bottom of the page the statement: "I agree to accept the charges for doctor and insurance."

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[1] Italicized by the Bureau.

In addition to these six southern companies, a company located in western Pennsylvania, employing in its steel plants 10,163 men, made deductions averaging about $1 per month from each for the support of the "mutual benefit association." The association performed a valuable service by aiding sick and injured employees, about one-fifth of the total receipts being devoted to sick benefits. The principal interest of the company in the association lies, however, in the fact that when an employee enters the association he thereby releases the company from liability for all accidents occurring in its plants. The arrangements for this are full and explicit. Embodied in the constitution of the benefit association is the following agreement between the association and the steel company:

ARTICLE XIV.—AGREEMENT AND GUARANTY.

SECTION 1. This association is based upon an agreement of ——— Iron Co., which has been legally assumed by ——— Steel Co., to act as treasurer of the association, and to supply office room and clerical services without cost to the association; also to give an annual gratuity to the treasury, equal to one dollar for each member of the association entitled to benefits during the whole year; also to guarantee the payment of all benefits to the members of the association by an advance or loan to the association from time to time of such sum or sums as may be needed, which shall be repaid from surplus income of the association from time to time, as it may be able to do so; in consideration of which every applicant for membership shall execute a release to the company employing him, herein named, of all action for damages resulting from accidents to him while he is a member of this association.

To make this agreement effective each employee when applying for membership in the association is required to sign an application blank containing the following clause:

And in consideration of the agreement and guaranty of ——— Steel Co., as set forth in Article XIV of the constitution of the ——— Mutual Benefit Association, I hereby release my said employer ——— Steel Co. of and from all actions that might be brought by me or any other person or persons for damages on account of personal injury or death resulting from accidents to me while I am a member of said association.

A complete release is thus secured by the steel company at the time the workman is employed, but in order to make the legal processes complete and binding each employee who has been injured and receives the benefits provided by the association is required to sign a paper releasing the steel company at the same time that the release of the benefit association is signed, a payment of $1 being the nominal consideration for the signing of this document.

The association is under the direction of officers elected by a board of directors, and these directors are appointed by the general manager of the steel company, so that the company practically controls the association. Moreover, the secretary who actually administers the fund and the physicians who make the decisions as to the termination of disability are employees of the steel company.

In this case, it is true, the company furnishes a hospital and makes various contributions to the association's fund, but the amount it thus expends is relatively small. During the 25 years of the association's existence it has paid out about $1,600,000 as compensation for accidents. Of this amount the steel company contributed approximately $200,000, receiving in return a complete release from liability for accidents occurring in its plants. A full description of the operation of this association and of its relation to the steel company will be found in Volume IV, of this report.

MEDICAL FEES.

Deductions for medical fees are more common than for the disablement funds just described. Of the 84 plants from which special agents secured information by personal visits, 20 made deductions from wages for medical fees. The usual custom is simply to employ a physician, but in a few cases a hospital is also maintained. Although the physician is always known as the "company doctor" and the hospital is called the "company hospital," the cost of their maintenance is derived entirely from the employees.[1] Sometimes medical care is furnished to the families of married employees as well as to the men themselves. In such cases the deductions are usually $1 per month for married men and 50 or 75 cents for single men. When the families are not included in the plan the deductions are the same for both classes of employees.

.Of the 23 plants visited in the Southern district, 14, with 7,861 employees, regularly made deductions for medical fees. The amount per month for each worker is shown in the following table:

MONTHLY DEDUCTION FOR MEDICAL FEES.

Number of plants making specified deduction.	Deduction for married men.	Deduction for single men.	Deduction for all classes.[2]
5	$1.00	$0.75	....
3	1.00	.50	....
3	....	....	$0.50
2	....	....	1.00
1	....	....	.75

Undoubtedly the maintenance of these funds is often a benefit to the employees, enabling them through cooperation to secure medical service at much lower rates than would be possible if each worker needing a doctor paid his own individual fees. Nevertheless, the arrangement is far from satisfactory, since in every establishment visited the funds, although derived wholly from the wages of the employees,[1] were administered by the officials of the company and the workers had no voice in either their collection or their distribution.

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[1] Only one exception to this general situation was found. In this case, owing to a strike and a consequent failure of deductions, a deficit in the medical fund had occurred and this the steel company made up. Except for this, the employers made no contribution of any kind to the medical funds.

[2] Families of married men not cared for.

A still more unsatisfactory situation and one which constitutes a real grievance in the minds of the employees is found in the cases in which this medical fund becomes a source of profit to the employing company. Take, for instance, one of the southern plants employing 1,000 men, and deducting fees of 75 cents a month from single employees and $1 from the married employees. Since in the South it is necessary to carry at least 50 per cent more men on the pay roll than are actually needed to fill the positions in the mill,[2] and since these deductions are made from all employees who appear on the pay roll, regardless of whether they have worked the full month or not, the total annual revenue available for the maintenance of the medical service is approximately $15,000.

As the families of the married workers are looked after, about 3,600 people are to be provided for from this fund. No hospital service is rendered, but doctors are sent and medicine is given free of charge in all cases where it is required. Two physicians are employed to care for these people, with salaries not exceeding $2,500 a year each, thus leaving $10,000 a year to supply "free medicine" and to defray all expenses incident to the administration of the fund. Under such circumstances it is not surprising that the workers should look upon the deduction as excessive.

DEDUCTIONS FOR COMPANY STORES AND COMPANY HOUSES.

Wherever company stores are conducted it is customary to deduct from the wages of the employees the amounts of any purchases from the stores. Such purchases are ordinarily made either by opening accounts at the store or by the use of store orders issued by the manufacturing companies and ordering the store to deliver goods to the bearer to the amount specified in the order. The orders are sometimes in the form of scrip, which is transferable and which passes current in the community.

Of the 84 plants investigated at this point by special agents of the Bureau, 23 operated company stores and, in addition, 10 plants issued orders on stores operated either by independent merchants or by interests affiliated with the steel company. In the Southern district, of the 23 plants investigated, 15 operated their own company stores and 4 issued orders on outside stores. There were only 4 plants in this district, therefore, which did not make deductions for company store accounts.

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[1] Only one exception to this general situation was found. In this case, owing to a strike and a consequent failure of deductions, a deficit in the medical fund had occurred and this the steel company made up. Except for this, the employers made no contribution of any kind to the medical funds.

[2] See Chapter XIV, p. 381.

It should be noted that, except in unusual cases, store orders are never issued nor is credit given at the company store to exceed the amount of wages already earned by the employee and standing to his credit on the books of the company. Instead, therefore, of such orders representing real credit given the employee at the company store, they are in effect payments made in advance by the employee. The entire question of company stores is fully discussed in Chapter XVI, but it is pertinent at this place to note the extent to which such deductions are made and the way in which they operate to relieve the company from the requirement of securing cash with which to pay the workmen.

Definite statements were secured from a number of companies with regard to the proportion of the total pay roll which was deducted on account of company store bills. Of 13 companies from which such statements were received, 5 reported deductions ranging from 35 to 56 per cent. The companies showing percentages of deduction over 35 per cent were in all cases small establishments. In 6 other companies, 3 of which were of large size, the deductions for this purpose amounted to 20 per cent or less of the total pay roll. It is of significance that the companies reporting deductions amounting to as much as 20 per cent of their pay roll pay their employees only once a month. In the table which follows the amount and per cent deducted for company store bills are shown for each separate establishment:

AMOUNT AND PER CENT OF TOTAL PAY ROLLS DEDUCTED FOR STORE BILLS BY 13 COMPANIES.

Establishment number.	Period shown.	Number of employees.	Total amount of pay roll.	Deductions for company store.	
				Amount.	Per cent of total pay roll.
1	Year 1910	146	$29,813	$15,890	55
2	Fiscal year 1911	109	60,306	30,081	50
3	Company's estimate	170	(1)	(1)	38
4	January to October, 1910	70	101,499	57,305	56
5	Company's estimate	175	(1)	(1)	32
6	....do	154	(1)	(1)	20
7	....do	150	(1)	(1)	30
8	October and November, 1910	100	10,601	4,141	39
9	Average per month	4,061	225,702	39,143	17
10	Fiscal year 1910	720	1,431,426	296,609	20
11	January to November, 1910	889	643,679	113,726	20
12	Year 1909	242	203,031	29,290	15
13	....do	280	144,053	25,246	16

[1] Not reported.

As an indication of the profits derivable from such practices may be mentioned the case of a plant with 105 employees which issued store orders on an outside store to the amount of 45 per cent of its total pay roll. It was discovered that for making such deductions the steel company received a commission of 10 per cent of the total amount of the orders issued.

The rent for company houses is, of course, deducted from wages whether such houses are leased directly from the steel company or from some affiliated or subsidiary company. This question is fully discussed in Chapter XVI, and need not be entered into at this point, as it presents no particular features of interest as regards the subject now under discussion. It may be noted, however, that in practically all cases the rentals for company houses are deducted in advance, although wages may be paid not oftener than once a month.

MINOR DEDUCTIONS.

ICE WATER.

One form of deduction which constituted a grievance on the part of the employees wherever it was encountered was that for ice water furnished during the summer months. In three plants in the Southern district with a total of 4,583 employees deductions for this purpose ranged from 25 to 50 cents per month per man according to the amount of ice used. In two other plants in the Southern district employing 1,043 men no deductions were made for this purpose, but the employees furnished their own ice. In these establishments the company furnished the water and the barrels. In one plant in Pennsylvania deductions for ice water were 10 cents per month in the case of men earning less than $2 per day and 20 cents per month in the case of all others. The plants noted as making deductions for ice water or in which the employees buy their own ice include, in the Southern district, all the steel-making plants visited in that district. In the blast-furnace plants no ice water is furnished. These deductions for ice water are said by some of the manufacturers to be made for the purpose of discouraging employees from drinking too much ice water during the hot summer months. Nevertheless, no steps had been taken in any of these plants to provide a suitable supply of properly cooled and filtered water in lieu of the ice water, to which objection was made.

IDENTIFICATION CHECKS.

Wherever brass checks or badges for the identification of employees are used it is customary to deduct from the wages of each employee a sum ranging from 25 to 50 cents for the check or badge. If the badge is turned in at the end of the employment the money is refunded, but if it is lost and a new badge is obtained the amount is retained by the company. As the cost of these checks and badges to the company is very much less than the amounts deducted, the deductions frequently appear to the employees to be exorbitant and unjust. The practice is defended by the companies who claim that while each check or badge unquestionably costs less than the amount of the deduction, the loss of a number of checks makes it necessary to purchase an entirely new set, as the checks and badges are serially numbered, and consequently the deductions do not more than cover the cost and trouble involved in keeping complete sets of such checks. It may be said, however, that the checks and badges are used entirely for the convenience of the company in keeping time and in making wage payments.

FINES, ETC.

Fines are very infrequent in the iron and steel industry. Practically the only reasons for which they are imposed are for failing to punch the time clock, for which a deduction of 1 hour's time is usually made, and for reporting late. Usually half an hour is charged when employees are late up to 30 minutes and 1 hour whenever they are late from 30 to 60 minutes. In one case, however, 1 full hour was deducted for all cases of reporting late of less than 30 minutes and 2 hours in case of reporting from 30 to 60 minutes late.

In addition to the deductions specified above, amounts are also deducted by various companies for a large number of other purposes, as, for example, the furnishing of fuel, light, water, and various other commodities at special prices to the employees. As full value is usually given in these cases it is unnecessary to discuss them in detail.

EFFECT OF DEDUCTIONS.

The deductions discussed in the preceding pages may have either or both of two effects: (1) They may reduce the real value of wages to the employee, or (2) since upon many of these deductions there is a profit, even when full value is given, they may diminish the final cost of production to the employer. It is impossible to estimate these two effects for the industry as a whole, but the following comparison between the practices of two specific companies will give some idea of the extent of their influence.

The two companies taken for comparison can not be considered typical, for the first represents conditions which are in every respect exceptionally good, while the second represents the extreme in the other direction. A large proportion of the employees in the industry, however, are affected by conditions very similar to those prevailing in the second.

These two companies manufacture nearly the same kind of product, which is in both cases highly finished, and though located in different parts of the country they compete for customers in the same markets. Company No. 1, located in eastern Ohio, pays 17 cents per hour for unskilled labor and has a 10-hour day, wages therefore amounting to $44.20 per month of 26 days. The employees are immigrants, chiefly Slavs. Company No. 2, located in Alabama, pays 12½ cents an hour for the same class of labor and also has a 10-hour day, wages therefore amounting to $32.50 per month of 26 working days. The employees are chiefly Negroes, with some Italians. On the basis of nominal wages, company No. 1 pays 36 per cent more than company No. 2 for the same general class of labor, this excess representing to some extent the difference in the cost of living in the two localities and also reflecting the difference in the efficiency of the workman.

As soon as the real value of the returns to the workman are considered the difference between the two companies is greatly increased. Company No. 1 has a system of profit sharing by which, if a man works steadily, he receives a sum equal to 5 per cent of his wages, thus bringing his monthly earnings to $46.41. It has also established a system of accident compensation by which any employee who is injured receives liberal benefits, the entire cost of the system being borne by the company. Wages are paid semimonthly, approximately 27 days after the beginning of the pay-roll period, but in case of necessity employees may secure advances in cash to the full value of wages actually earned.

Company No. 2 has no profit-sharing scheme. One-half of one day's wages is deducted each month to create the "workmen's benefit fund," which has been described above (p. 395). A further deduction is made each month for medical service, amounting to 75 cents for single and $1 for married employees. Since in the case of these laborers sickness is rare, and their disabilities are usually due to accidents, this deduction might properly be looked upon as part of the benefit fund, i. e., a deduction for benefits which the employees of the first company receive gratuitously and in far more liberal amounts. Moreover, for 18 weeks during the warm weather the employees of the second company spend five cents a week for ice, which is furnished free by the first company. In company No. 2 wages are paid monthly and approximately 40 days after the beginning of the pay-roll period. In order to obtain cash for ordinary requirements, it is customary for the unskilled laborers to secure advances averaging at least one-fourth of their monthly wages. These advances the company makes at a discount of 20 per cent, the loss per employee amounting to $1.60.

Assuming, then, that the employees of the second company receive full value for the deduction for medical services, and therefore omitting it from consideration, the deductions from their wages for benefits or accommodations which employees of the first company receive without charge are: For compensation system, 63 cents a month; ice (average per year), 8 cents monthly; discount on wage advances, $1.60; total, $2.31; so that the monthly cash receipts of unskilled laborers in the second company's employ would be $30.19. But the unskilled laborer employed by company No. 1 may receive $46.41 monthly, so that while the difference in nominal wages is 36 per cent, the difference in cash received by the laborers is or may be 54 per cent in favor of the employees of the first company.

Looked at from the standpoint of cost of labor to the employer, or rather of amount of cash paid for labor by the employer, the difference is even greater. Company No. 1 pays to begin with 36 per cent higher wages. It provides at its own expense far more liberal compensation for accidents than the second company provides through deductions from the pay of workers. It furnishes free the ice, for which the second company's employees must pay, and it makes no profit by discounting its own advances on wages. On these three items the first company pays out, as part of its labor cost, sums which the second company transfers to the expense accounts of its workers, sometimes, as in the case of the discount on advances, making a handsome profit for itself on the transaction.[1]

But in addition to these differences the second company also operates a company store and rents to its employees a large number of company houses. On these two classes of property it makes a profit amounting at a minimum estimate to not less than 5 per cent of the total pay roll. Since the employees receive nearly or quite full value, these profits can not be looked upon as deductions from their wages, but they may fairly be taken into account as diminishing the relative outlay for labor of the two plants. Making due allowance for the various profits and deductions secured by the second company, the difference in the outlay of the two companies per common laborer is not less than 70 per cent.

In view of this enormous difference it is of interest to note that company No. 1, whether in spite of or owing to its high wages and liberal policy, is prosperous, paying regular dividends of 8 per cent, while company No. 2, which from its organization has pursued much the same policy as at present, is bankrupt. Both companies were organized within the past 10 years.

INDIRECT ADDITIONS TO WAGES.

So much has been said about deductions from wages that it is only fair to consider also various plans put into effect by some of the companies which, while not increasing nominal wages, add considerably to the real value of the employee's return for his labor. Three leading plans of this kind have been put into operation—voluntary compensation plans, pension systems, and profit-sharing systems.

The first of these to be put into effect was the establishment of funds, provided by the employer, out of which a definite compensation would be paid employees in case of accidental injury. Such funds have been established by the United States Steel Corporation, the Wisconsin Steel Co. (International Harvester Co.), and the Youngstown Sheet & Tube Co. These companies together employ more than 50 per cent of the total number of persons in the industry, and their action in establishing such funds has been of great importance, not only through its direct effect on their own numerous employees, but through its influence as an example. The operation of these plans need not be considered here, as the subject is fully discussed in Volume IV of the present report. Theoretically the compensation paid out of such a fund is merely a voluntary substitute for the remedies provided for the employees by the common law. As a matter of fact, however, relief through the common law can be secured only at considerable expense to the injured employee, and in only a narrow range of cases. Consequently the existence of such funds from which compensation for accidents is made without cost to the employee is a real benefit to every worker.

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[1] In addition the second company almost certainly made a profit upon the fund for medical service, but as the facts concerning this could not be fully learned, the item is omitted.

The plan of pensioning employees has been put into effect by only two companies, the United States Steel Corporation and the Wisconsin Steel Co., which is a subsidiary of the International Harvester Co. The operation of this plan is described in considerable detail in Chapter XVII of this volume, so that it need only be mentioned here. The value to the employee of the right to participate in the advantages of such a plan is obvious.

A strictly profit-sharing plan, affecting the employees as a whole, is in use in only one company. The United States Steel Corporation makes some approach to such a measure in its "bonus plan" and in its so-called profit-sharing plan, but the first of these applies only to the more highly paid employees, and the second operates only indirectly through the sale of stock to employees at a special price. There is, of course, a certain potential value to the employee in such plans, but definite action and the possession of a capacity for saving are necessary before their benefits can be secured.

In the profit-sharing plan of the one company referred to, the benefits are open to all who are in the employ of the company on the last day of its fiscal year—June 30—with the exception of four of the higher officials and a few who are members of a certain trade-union. These last are excluded on the ground that they are receiving a scale of wages proposed by the union itself, and that the company does not feel under any obligation to increase these wages voluntarily. Full details of this plan are given in Chapter XVII. Here it is sufficient to note that during the two years in which the plan has been in operation the employees have received as their share of the profits 5 per cent of the amount earned by each during the fiscal year. If a workman leaves the employ of the company but returns during the year, the amount of earnings upon which his share of the profits is based is reckoned from the time of his reemployment. No obligation is incurred by the employee through the acceptance of this additional sum, and no action on his part is required to qualify for it, beyond being in the employ of the company on the last day of the fiscal year.

All these plans, of course, are established by the companies largely because of the benefits which they believe they will themselves receive through their action. Nevertheless, their value to the employee and the real addition which they make to the nominal wages must be recognized.

BONUS PLANS.

Bonus plans and similar devices for increasing production are not very generally used in the steel industry. Not a single plant was found during the present investigation in which a well developed bonus system was in operation throughout the plant; if such plans were used at all they were found only in connection with particular occupations or operations.

One reason for this state of affairs lies in the fact that most of the work in the steel industry is performed by crews of men working together as a unit, while the full advantages of the bonus system can be obtained only when the amount or character of work done depends on the individual initiative of each employee. Sometimes an effort is made to meet this situation by selecting one man, usually either the supervisor of the crew or the workman who has charge of the first step in the process and who consequently is in a certain sense a pace setter, and paying him a bonus proportioned to the production of the entire crew. The employees strongly object to this plan on the ground that the bonus goes to one man only, while the extra work on which it is based is performed by the whole crew. This system is not characteristic of the steel industry, although it is used with comparative frequency.

In order to give an idea of the general nature of the bonus systems used in the steel industry, a few examples of the more common types are given in the following pages. No discussion of these systems seems necessary, as they are for the most part very simple and are fully described in the text.

BLAST FURNACES.

Plant No. 893 employs a bonus system in its blast furnaces, having installed it, according to the general superintendent's statement, in order to "awaken a more active interest in the employees in the execution of their work, and thereby develop greater care, a keener interest, and a higher standard of efficiency so as to make their services of more value both to themselves and to the company." Seventy-five employees are affected by the system—62 workmen and 13 others occupying positions of a more or less supervisory character. The conditions under which a bonus can be earned, and its amount, naturally differ according to the work done by the employee.

WORKMEN.—The workmen affected are 8 blowers and 12 hot-blast men, known as front of furnace workers, 20 motor men, 12 hoist men, 4 ore-car men, 4 stock-house foremen, and 2 weighmen. These are paid a bonus on the analysis or grade of iron produced on their particular furnaces. This bonus is paid when more than 50 per cent of the monthly production grades as "standard iron." The Bessemer standard is based on 0.9 to 1.3 per cent silicon and under 0.045 per cent sulphur, and the basic standard is based on 0.6 to 1 per cent silicon and under 0.05 per cent sulphur. When more than 50 per cent of the month's production is up to standard a bonus is paid ranging from 1 per cent of the wage received for 51 per cent standard iron up to 20 per cent for 100 per cent of standard iron. The latter standard is frequently produced.

ASSISTANT SUPERINTENDENT.—This official receives three separate bonuses—one on all tonnage produced in excess of a certain amount, one on any reduction below a fixed cost per ton for iron produced, and a third on any reduction in the amount of coke used per ton of iron produced.

The first of these bonuses is based on a standard monthly production for the six blast furnaces of this plant of 70,000 tons. The regular tonnage rate on this amount is 25 cents per 1,000 tons, while for any excess production the assistant superintendent gets a bonus according to the following scale:

BONUS SCALE FOR ASSISTANT SUPERINTENDENT IN BLAST FURNACES, PLANT NO. 893.

Monthly production above standard (gross tons).	Bonus per 1,000 tons above standard.
1,000 and under	$0.25
Over 1,000 to 2,000	.75
Over 2,000 to 3,000	1.25
Over 3,000 to 4,000	2.00
Over 4,000 to 5,000	3.25
Over 5,000 to 6,000	5.25
Over 6,000 to 7,000	8.50
Over 7,000	10.00

According to this plan, if the output for a given month is 78,000 tons, the assistant superintendent receives besides his salary the regular tonnage rate amounting to $19.50, and in addition the bonus of $10 for the production of 8,000 tons above the standard of 70,000 tons.

As a basis for the second bonus, $1.40 per ton of iron has been set as a standard cost which should cover operating labor, repair labor and material, supplies, expense for power, and for railroad transfer; in fact, everything except raw material. If the average cost for these items is reduced to $1.35 per ton of iron a bonus of $4.50 is paid, and further reductions are met with larger bonuses, until at a cost of $1.15 per ton the maximum bonus of $40 is paid. This bonus is based on a six months' average, but is paid monthly pro rata.

The third bonus is paid on any reduction in the average amount of coke used to produce a ton of iron. Twenty-six hundred pounds of coke is the standard allowance per ton of iron produced, and the bonus is paid on the average monthly tonnage of the six furnaces. For every pound by which the standard consumption of coke is reduced a bonus is paid according to the following scale: From 2,600 down to 2,500 pounds, 5 cents; from 2,500 down to 2,400 pounds, 10 cents; from 2,400 to 2,300 pounds, 13 cents; and from 2,300 down to 2,250 pounds, 15 cents.

During the year 1909 the bonuses received by the assistant superintendent averaged $40 per month.

ENGINEERS IN BLOWING ROOM.—Eight first engineers in the blowing room receive a bonus amounting to 10 per cent of their wages for any reduction they effect in the cost of operating labor, repairs, and supplies below a fixed standard. The standard cost allowed is for No. 1 and No. 2 furnaces, 10 cents per ton of iron produced; for No. 3 and No. 4 furnaces, 7.1 cents per ton; for No. 5 furnace, 7.4 cents per ton, and for No. 6 furnace, 9.5 cents per ton.

CHIEF ENGINEER.—The chief engineer receives a bonus amounting to 10 per cent of his wages for any reduction below the standard cost of operating labor, repairs, and supplies for five of the six blast furnaces of the plant. The standard cost allowed for these items is 8.3 cents per ton of iron produced, based on a six months' average.

MASTER MECHANIC.—The master mechanic receives a bonus amounting to 10 per cent of his wages for any reduction below the standard cost of production for furnace No. 6. The standard cost allowed at this furnace is 9.5 cents per ton of iron produced, this allowance covering operating labor in engine house, repairs, material, and cupolas.

REPAIR FOREMAN.—The repair foreman receives a bonus amounting to 10 per cent of his wages for any reduction he may effect in the cost of repairs and supplies (based on a six months' average) below the standard cost of 4.6 cents per ton of iron produced.

CHIEF ELECTRICIAN.—The chief electrician receives as a bonus 10 per cent of any amount he may save by reducing the cost of production below the standard allowance of $1.85 per 1,000 kilowatts developed. The bonus is calculated on a six months' average.

STEEL WORKS AND ROLLING MILLS.

Plant No. 706 has a somewhat different system. In accordance with a plan established January 1, 1907, a bonus is paid for production beyond a stipulated amount in the blast furnaces and steel works, the skelp furnaces and the pipe mills. For the blast furnaces and steel works, the standard production, the bonus on excess production, and the employees who receive bonuses are as follows:

BONUSES IN BLAST FURNACES AND STEEL WORKS, PLANT NO. 706.

Occupation.	Bonus per 100 tons in excess of specified production.	Production beyond which bonus is paid.		
		Tons.	Kind of product.	Period of production.
Superintendent, blast furnaces	$0.50	34,000	Pig iron	Month.
Foreman, blast furnaces	.37½	34,000	do	Do.
Chief engineer, blast furnaces	.20	34,000	do	Do.
Superintendent, converters, bloom and slab mills	.60	31,000	Billets and slabs	Do.
Assistant superintendent, converters	.40	36,000	Bessemer ingots	Do.
Master mechanic, steel works	.25	36,000	do	Do.
		31,000	Billets and slabs	Do.
Assistant master mechanic, steel works	.10	31,000	do	Do.
		36,000	Bessemer ingots	Do.
Turn foremen, bloom and slab mills	.80	15,500	Billets and slabs	Half month.
Turn foremen, converters	.80	18,000	Bessemer ingots	Do.
Blowers, converters	.50	18,000	do	Do.

SKELP MILLS.

A bonus is paid in the skelp mills, based upon a minimum tonnage for all four mills (plate mill, 16-inch mill, 13-inch mill, and 42-inch mill) of 25,000 tons per month. The estimated maximum tonnage possible for these four mills is 39,000 tons per month. If the mill is running at a rate of production in excess of 25,000 tons, a bonus is paid for every ton in excess of that production, and this is the case whether the mill is or is not operating the entire month.[1] For example: The mill might operate exactly half the working days of a month and produce 14,000 tons, whereas the base provides for only 12,500 tons for half a month. Consequently the difference of 1,500 tons excess production for half a month would be extended to represent the bonus due for the full month if the mill had been operating and the recipients of the bonus paid for 3,000 extra tons.

The rate of bonus for excess tonnage again depends upon the "practice" in getting out the production—that is, the percentage of product from the material charged. This bonus is paid to the assistant superintendent, the foreman of the roll shop, and the master mechanic, and the rates for excess production over 25,000 tons per month for the different degrees of "practice" are as follows:

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[1] In calculating the time operated no account is taken of delays due to breakdowns, repairs, etc. The mills are counted as running except when they are shut down for lack of orders or some similar cause.

BONUSES IN SKELP MILLS, PLANT NO. 706.

"Practice" (per cent product is of material used).	Bonus, per 100 tons, in excess of 25,000 tons per month paid to—		
	Assistant superintendent.	Roll foreman.	Master mechanic.
80	$0.15	$0.05	$0.05
81	.20	.10	.10
82	.25	.15	.15
83	.30	.20	.20
84	.35	.25	.25
85	.40	.30	.30
86	.45	.35	.35
87	.50	.40	.40
88	.55	.45	.45
89	.60	.50	.50

The "practice" in 1907 was: Plate, 78.05 per cent; 16-inch, 76.10 per cent; 13-inch, 76.51 per cent; 42-inch, 82.07 per cent; average for the year, 78.26 per cent.

PIPE MILLS.

Bonuses in the pipe mills are based upon the cost of production, exclusive of metal charged, and are as follows:

Night foreman, butt mill, one one-hundredth of savings below base cost of $2.66 per ton, exclusive of material, for butt-welded skelp produced.

Foreman of foundry, one-fiftieth of savings below base cost of $17.40 per ton, exclusive of material, for iron castings produced.

Foreman of coupling department, one one-hundredth of savings below base cost of $25 per ton, exclusive of material for finished couplings. (Divided equally between day and night foremen.)

Assistant foreman of coupling department, one one-hundredth of savings below base cost of $13.85 per ton, exclusive of material, for welded couplings produced. (Divided equally between day and night foremen.)

Foreman of bricklayers, one-twentieth of savings below base cost of 16 cents per ton for rebuilding furnaces, butt and lap refractories.

Foreman of lap welding, one one-hundredth of savings below base cost of $5.37 per ton, exclusive of material, for lap-welded skelp produced.

Foreman of lap welding, one one-hundredth of savings below base cost of $5.37 per ton, exclusive of material, for lap-welded skelp produced.

Chief of safety department, $2 per point below base of 0.015 per cent of time lost due to accidents compared with average number of employees.

TUBE MILLS.

Plant No. 929 has an extensive bonus system in its tube mill, but uses no bonuses in other departments. The officials explain this on the ground that while the system might work to advantage elsewhere there is no other department in which every move counts for so much, and in which consequently a bonus is so effective, as in the tube mill.

In this plant at all butt-weld furnaces a bonus is paid to welders, shove ups, and chargers and at all lap-weld furnaces to welders, roll setters, benders, and turn downs. The system, which was established in 1903, bases the bonus upon the number of pieces above a certain fixed base produced hourly. Twice since the inauguration of the system, once in 1904 and again in 1907, the base number of pieces has been increased. The officials justify this increase by saying that when the system was introduced the men, being inexperienced, were slow, and as a consequence the base was fixed unnecessarily low. Another change, made in 1909, was that of including the chargers at butt-weld furnaces in the operation of the bonus system.

The following tables show for each size of tubing the number of pieces per hour fixed as a base and the bonus paid in each occupation for each hundred pieces or fraction thereof produced per hour above this base. The average production per hour is also shown for all sizes which have been produced recently.

BONUSES IN LAP FURNACES NOS. 1 AND 10, PLANT No. 929.

[Runovers, rundown, extra strong, and double extra strong are not included in this schedule.]

Size of product.	Base rate of production (pieces per hour).	Average production per hour, January to September, 1910 (pieces).	Bonus rate per 100 pieces for all production above the base.			
			Welders.	Roll setters.	Benders.	Turn-downs.
Pipe:						
5-inch	40	44	$1.25	$0.70	$0.60	$0.60
6-inch	35	49	1.40	.80	.70	.70
7-inch	30	35	1.70	.90	.80	.80
8-inch	25	36	2.00	1.10	1.00	1.00
9-inch	20	28	2.50	1.35	1.20	1.20
10-inch	20	22	2.50	1.35	1.20	1.20
12-inch	15	16	3.40	1.80	1.60	1.60
Casing:						
5-inch	40	(1)	1.25	.70	.60	.60
5$\frac{3}{16}$-inch	40	47.5	1.25	.70	.60	.60
5$\frac{5}{8}$-inch	40	41.3	1.25	.70	.60	.60
6$\frac{1}{4}$-inch	35	42	1.40	.80	.70	.70
6$\frac{5}{8}$-inch	30	45	1.70	.90	.80	.80
7$\frac{5}{8}$-inch	20	32	2.50	1.35	1.20	1.20
8$\frac{1}{4}$-inch	20	26	2.50	1.35	1.20	1.20
8$\frac{5}{8}$-inch	20	(1)	2.50	1.35	1.20	1.20
9$\frac{5}{8}$-inch	20	21	2.50	1.35	1.20	1.20
10-inch	20	22	2.50	1.35	1.20	1.20
11$\frac{5}{8}$-inch	18	19	2.80	1.50	1.35	1.35
12$\frac{1}{2}$-inch	15	14	3.40	1.80	1.60	1.60
13$\frac{3}{8}$-inch	12	(1)	3.40	1.80	1.60	1.60
Regular wage per hour			.50	.27	.24	.27

[1] Not reported.

BONUSES IN BUTT-WELD FURNACES, PLANT No. 929.

[Runovers, extra strong, and double extra strong are not included in this schedule.]

Size of pipe.	Base rate of production (pieces per hour).	Average production per hour.	Bonus rate per 100 pieces for all production above the base.		
			Welders.	Shove ups.	Chargers.
⅜-inch	325	550	$0.132	$0.066	$0.016
½-inch	350	680	.118	.059	.014
¾-inch	375	613	.118	.059	.014
1-inch	300	473	.142	.071	.017
1¼-inch	250	430	.161	.080	.019
1½-inch	200	370	.177	.088	.021
2-inch	175	273	.237	.118	.029
2½-inch	110	162	.323	.161	.040
3-inch	75	135	.473	.237	.059
Regular hourly wage			.375	.182	.180

On certain sizes of tubing made in butt-weld mills records in the rate of production have been made at this plant considerably higher than the averages shown above. These records follow:

MAXIMUM PRODUCTION OF SPECIFIED SIZES OF TUBING IN BUTT-WELD FURNACES, PLANT No. 929.

Size of tubing.	Pieces in 10 hours.	Pieces in 12 hours.
⅜-inch	6,780	7,685
½-inch	7,915	9,080
¾-inch	6,406	9,358
1-inch	7,120	....

OPEN-HEARTH FURNACES.

In plant No. 999 the bonus system is scarcely used outside of the open-hearth department. Within it bonus payments are made as follows to the specified employees, provided they do not miss a producing turn:

Each melter gets a bonus on the percentage of ingots produced by the furnaces under his charge which are up to specifications. For 80 per cent the bonus is $10; for 85 per cent, $20; for 90 per cent, $30; and for 100 per cent, $100.

Other employees receive bonuses on each 100 tons above an average production of 50 tons per furnace per turn, the amount of the bonus varying as follows: First helpers, 25.6 cents; second helpers, 21 cents; third helpers, 19.2 cents; steel pourers, 33 cents. The north end and south end crews each have charge of six furnaces, and the bonus tonnage is figured on the basis of the average production of their respective furnaces.

The following employees each receive a bonus on the average production, in excess of 50 tons per turn per furnace, of the entire 12 furnaces.

BONUSES IN OPEN-HEARTH FURNACES, PLANT NO. 999.

Occupation.	Bonus per 100 tons bonus tonnage.
Locomotive engineers	$0.269
Locomotive switchmen	.151
Pit laborers	.088
Stock-yard engineers	.229
Stock-yard switchmen	.180
Scrap laborers	.144
Stockers	.144

The firemen of the gas producers for the open hearth receive $4.50 per 100 tons of all bonus tonnage produced by their respective furnaces, provided they work every turn that the open hearth operates. The total bonus earned at this rate is divided among the four firemen.

The officials consider that the bonus system in this department has had two marked effects—it has developed a high degree of cooperation among the men and it has greatly increased the regularity of the important men around the open hearth. The first result is due to the fact that the bonus tonnage is calculated on the average production of six furnaces at each end of the department, so that every helper is anxious to get each furnace into working order as quickly as possible, and as a consequence they are on the alert to discover ways of working together most effectively.

The assertion that the bonus system tends to increase the regularity of the workers to whom it applies was tested by an examination of the records of the bonus and nonbonus men for the month of October, 1910, a further examination showing that this month was in nowise abnormal. All "floaters" were eliminated from consideration.

For that month there were 69 workers in the bonus positions and 324 in the nonbonus. Of the 69 bonus men 5 were either employed after the month had begun, transferred to other work, or left the company, so that it was an impossibility for them to work every shift. Of the 64 remaining 48 worked full time, 10 lost 1 and under 6 shifts, 5 lost 6 and under 11 shifts, and 1 lost 23 shifts.

Of the 324 nonbonus men 74 lost time owing to late employment, transfer, discharge, or vacation, and 8 others lost time because their furnaces were down, leaving 242 who might have made full time. Of these, 135 actually made full time, 51 lost between 1 and 6 shifts, 32 lost between 6 and 11 shifts, 7 lost between 11 and 16 shifts, 10 lost between 16 and 21 shifts, and 7 lost between 26 and 31 shifts.

Comparing the results for the two sets of workers, it appears that among the 64 bonus men who might have been regular 75 per cent did not miss a single shift, while among the nonbonus men who also might have made full time only 55.8 per cent worked every shift. Moreover, among those of the bonus men who failed to make full time only 37.5 per cent missed 6 or more shifts, while among the nonbonus men who were irregular 52.3 per cent missed 6 shifts or more.

The comparison is not a wholly satisfactory one owing to the difference in size of the two groups, but so far as it goes it is confirmatory of the official statement that the bonus system promotes regularity among the workers to whom it applies.

There was no complaint against the bonus system from the workmen in this plant. On the contrary, all the men interviewed were very much in favor of the system because it gave them a chance to earn more money. It could not, they said, be used as a speeding-up device, since the production of the furnace could not be greatly increased; its only result in this direction is to insure getting the heats out on time. Moreover, as all the workmen connected directly with the furnace share in the bonus, there is no discrimination to arouse bitterness, and no feeling that the bonus men are getting all the benefit of an output due as much to others' efforts as to their own.

CHAPTER XVI.

COMPANY HOUSES AND COMPANY STORES.

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INTRODUCTION.

The subject of company houses and company stores requires careful consideration, not only because of the number of such institutions in the iron and steel industry but because abuses of various kinds are likely to develop in connection with their operation. It is, therefore, not enough to know simply the number of companies that are providing houses or are conducting stores for their workmen, but it is necessary also to know just how and under what conditions the houses are provided or the stores are conducted. It is almost impossible to generalize with regard to any phase of the subject, since the conditions existing at any given plant are in large part the result of the characteristics and purposes of the management. For example, it is sometimes true that in company houses excellent accommodations are furnished to the workmen at extremely reasonable rates and that no onerous conditions are attached to occupancy. Frequently, however, company houses are made a source of great profit and such conditions are imposed upon the lessees that their liberties are seriously interfered with. Similarly, company stores may sell commodities at low prices and may be managed in such a way as to be a great convenience to employees, but such stores are frequently used, as was developed in the present investigation, to secure for the employer a high rate of profit and, to a certain degree at least, to control the actions of the employees. Therefore, in the present study generalizations are avoided, and in their place brief descriptions are given of conditions existing in particular communities.

Company houses and company stores are most frequently found in the Southern district. In other parts of the country they are not only less prevalent, but their existence is in most cases simply incidental and without any great effect on the working and living conditions of the employees. In the South a large number of the plants are completely isolated, and in many cases the company houses and the company store constitute practically the only buildings in the community. It is in such situations that both of these institutions must be recognized as almost unavoidable, but it is in these isolated communities that the most serious abuses are likely to develop.

In considering the question of company houses and company stores it has been necessary to include not only the cases in which the manufacturing company exercises direct ownership, but also those in which a separate company, more or less closely affiliated with the manufacturing company, has been organized to own and conduct the houses or stores. Generally, in the case of company stores this indirect form of ownership develops because of laws prohibiting manufacturing companies from owning or conducting such stores. The procedure in such cases is usually to organize a separate corporation, the principal stockholders of which are either officers or stockholders of the manufacturing company. As these corporations are usually of small size, with a limited number of stockholders, no reports are published and little information with regard to their ownership and operations are made public. In the present investigation an attempt was made to ascertain the ownership of all stores in the communities studied. Where this was impossible it seemed proper to consider a store as being essentially a "company store," if the community generally considered it so and if also the manufacturing company issued store orders or regularly deducted store bills from the wages of its employees without a formal agreement being made by the employee. There were only two instances in the investigation in which it was necessary to depend upon such indirect evidence.

In the following discussion the subject of company houses is given the greater amount of space, not only because company houses are much more frequent, but because there is much less uniformity in the accompanying conditions than is the case with the company stores.

COMPANY HOUSES.

The housing of employees is considered in this investigation no further than as affected by the ownership and control of houses by steel companies or their affiliated land companies. This limitation is made because the subject of housing and general living conditions in each of the important "steel towns" was thoroughly investigated by the Immigration Commission in 1908, and a full report thereon has been made to Congress in volumes 8 and 9 of the series prepared by that commission.

Of the 74 establishments from which information was secured on the subject, 56 were actively interested in the problem of housing their employees. In many cases, however, the interest consisted merely in the incidental ownership of a few houses, bought either to secure the land for ultimate plant extensions or for their general property value. Such conditions are of little significance in the present inquiry, because of the few employees affected and also because the owner in such cases acts practically as a private owner in dealing with his tenants.

The conditions that are of particular importance in this inquiry are those where definite steps have been taken by the steel companies to furnish houses and other accommodations for a large number of their employees and where the plans have been carried far enough to give manifestation of a definite policy. In the following study of the question, attention is first given to a few communities in which the steel company has undertaken to house a large number of its employees. Since the identity of these communities is of no significance, they are denominated by letters.

As in all housing inquiries, so in discussing company houses it is necessary to direct attention to the accommodations which are provided for the semiskilled and unskilled employees particularly.

Houses which are provided for foremen and highly paid employees are usually sanitary and of good construction. The only abuse which is likely to arise in such cases is the charging of exorbitant rents, and this can hardly occur except in isolated communities where other dwellings are not available. Even in the isolated communities it was found that the houses provided for the skilled employees and foremen were almost without exception good dwellings and were rented at reasonable rates. Indeed, the more isolated a community is the greater the attention that is devoted to making all conditions as favorable as possible for the skilled workmen, because otherwise it would be difficult to induce them to come into such communities.

With the unskilled workmen the situation is entirely different. They are easily induced to go to almost any community by the promise of steady work at a fair wage, and they ask few questions about the living conditions which they will find, accustomed as they are to adjusting themselves to the most unfavorable environment. When they arrive and start work, even if they are housed in the worst manner possible and are charged exorbitant prices for their accommodations, they are unable to leave immediately, because railroad fare is a serious problem and there is nothing to be gained by leaving until they are reasonably sure of a good job in some other locality. Frequently, before they are in a position to move, they have grown accustomed to the environment and continue to live in it for years, however distasteful it may have been at first.

An example of such conditions is to be found in community A, where the steel company has erected for its salaried employees and skilled workmen houses of an excellent type and rents them at very reasonable rates, but is content to house its many unskilled laborers in cheaply constructed shanties for which exorbitant rents are charged. So great is the disparity in the rental rates for these different types of houses that one shanty 24 feet square, in which 17 men are crowded, brings in only $2 less per month than the 2½-

story house with 11 rooms and bath, renting for $19 per month, which at the time of this investigation was occupied by one of the officials.

COMPANY HOUSES IN IMPORTANT STEEL TOWNS.

COMMUNITY A, EASTERN DISTRICT.

The most noteworthy example of a complete steel community, planned, constructed, and controlled by a steel company encountered in the present investigation is located in the Eastern district, which it will be remembered includes New Jersey, eastern Pennsylvania, and Maryland. With the exception of a few teachers, clergymen, and physicians the residents of this community are entirely dependent on the steel company for employment. The superintendent of the public schools stated to agents of the Bureau that he considered himself "practically an employee of the company." This school superintendent lives in a company house, is justice of the peace, before whom all cases of the employees are heard, and is also coroner, whose duty it is to hold inquests in all cases of death from accidents occurring in the steel works. All policemen in the community are employees of the company. There is no municipal government in which the inhabitants share, all ordinary governing powers being vested in the company and the justice of the peace mentioned above. The president of the company in discussing the situation said that "on account of the peculiar conditions existing it had been necessary for the company to assume a decidedly paternalistic attitude toward its employees."

The company owns every dwelling in the community, and also owns every acre of land in the immediate vicinity upon which a dwelling could be constructed. It also owns the only railroad entering the community. This road is the principal means of travel for its employees, but there is also a street railway, which is owned by the traction company of the neighboring city. Through a separate company, in which its president stated "the steel company had a financial interest," the only store in the community is operated. The store is a complete department store, and in 1910 sold to employees goods to the amount of $745,816. In addition the company operates a bakery, a dairy, a truck farm, and an abattoir in the immediate vicinity.

The broad scope of company ownership in the case of this plant was due to its remoteness from any city or village with sufficient housing capacity for so numerous a force as the manning of a large steel works necessitates. Therefore a town was planned, streets were laid out, and a large number of dwellings of various types were constructed. At the time of the investigation the population of this village was approximately 6,000 persons, 4,500 white and 1,500 colored.

Large, commodious, detached houses on ample lots were built for the high-salaried employees holding supervisory positions, comfortable houses and cottages were erected for its skilled employees, and shanties were put together for its unskilled immigrant and Negro laborers.

HOUSING OF OFFICIALS AND SKILLED WORKMEN.

The houses of the officials and skilled workmen are all fairly well designed for convenience and are substantially constructed. The streets along which they are built are well kept and lined with shade trees. The majority of the houses have front porches. Narrow board walks run from the porches to the board sidewalks of the street. These walks are kept in good repair by the company. Back of each house is an ample lot, usually converted into a flower garden, and as a rule well kept. This is true not only in the case of the larger houses, but of the less pretentious ones as well. Cash prizes offered each year by the company for the best kept yards have stimulated an intense rivalry which has resulted in floriculture of a high order. All householders are required to keep garbage in cans with tight covers on them. These cans are kept at the rear of the lots, which in most cases run back to a wide alley, and the company maintains an efficient garbage collection department. The fact that the leases prohibit "keeping horses, cattle, sheep, swine, goats, or any other animals that will be dangerous to persons or will be prejudicial to a clean, tidy, and proper use of the premises; also, the keeping of any geese or ducks and the keeping of chickens, unless confined," accounts in a great measure for the general neatness and cleanliness of the premises. The following tabulated statement presents the facts regarding the number of houses, materials, size, condition as to modern conveniences, and rental rates.

DESCRIPTION AND RENT PER MONTH OF 636 HOUSES MAINTAINED BY A STEEL COMPANY IN THE EASTERN DISTRICT.

Number of houses.	Construction.	Number of rooms.	Rent per month.	Water—			Water-closet in or out.	Bath.
				On first floor.	On second floor.	Hydrant outside.		
1	Frame	12	$20.00	Yes	Yes	No	In	Yes.
8	do	11	20.00	Yes	Yes	No	In	Yes.
2	Brick	11	20.00	Yes	Yes	No	In	Yes.
4	Concrete block	11	20.00	Yes	Yes	No	In	Yes.
1	Frame	10	19.00	Yes	Yes	No	In	Yes.
1	do	10	7.50	No	No	Yes	Out	No.
8	do	9	16.00	Yes	Yes	No	In	Yes.
4	do	9	15.00	Yes	Yes	No	In	Yes.
4	Brick	9	14.50	Yes	Yes	No	In	Yes.
4	Frame	9	14.00	Yes	Yes	No	In	Yes.
6	do	9	13.00	Yes	Yes	No	In	Yes.
2	Concrete block	8	20.00	Yes	Yes	No	In	Yes.
1	Frame	8	19.00	Yes	Yes	No	In	Yes.
1	do	8	16.50	Yes	Yes	No	In	Yes.
80	do	8	[1] 12.00	Yes	Yes	No	In	Yes.
48	do	8	[1] 10.00	Yes	Yes	No	In.[2]	Yes.
1	do	7	16.50	Yes	Yes	No	In	Yes.
2	do	7	15.00	Yes	Yes	No	In	Yes.
14	Brick	7	10.50	Yes	Yes	No	Out	Yes.
1	Frame	7	6.50	No	No	Yes	Out	No.
12	Brick	6	10.00	Yes	Yes	No	Out	Yes.
32	Frame	6	8.50	Yes	Yes	No	Out	Yes.
24	Brick	6	8.00	Yes	Yes	No	Out	Yes.
96	Frame	6	6.50	Yes	No	No	Out	No.
24	do	6	6.50	No	No	Yes	Out	No.
16	do	6	6.00	No	No	Yes	Out	No.
168	do	6	5.50	No	No	Yes	Out	No.
20	do	5	6.00	Yes	No	No	Out	No.
2	do	5	6.00	No	No	Yes	Out	No.
20	do	5	5.00	No	No	Yes	Out	No.
2	do	5	2.00	No	No	Yes	Out	No.
2	do	4	4.00	No	No	Yes	Out	No.
15	do	3	4.00	No	No	Yes	Out	No.
10	do	3	2.00	No	No	Yes	Out	No.

[1] End or corner houses $1 more per month.

[2] On back porch, first floor.

This table shows 574 frame, 56 brick, and 6 concrete block houses, a total of 636, rented to employees. Classified by number of rooms there are 1 of 12 rooms, 14 of 11 rooms, 2 of 10 rooms, 26 of 9 rooms, 132 of 8 rooms, 18 of 7 rooms, 372 of 6 rooms, 44 of 5 rooms, 2 of 4 rooms, and 25 of 3 rooms.

Two hundred and fifty-nine, or 40.7 per cent, of the houses have water on both first and second floors and bathrooms. Of these 259 only 177 have inside toilets. In 48 cases these inside toilets are on the back porch adjoining the dining room, or, in a number of instances, the kitchen. In 375 houses, or 59 per cent of the total number, there is water inside, while in 261, or 41 per cent, the water supply is obtained from hydrants either in the yards or streets. In the cases where the hydrants are in the street, one usually supplies a number of tenants.

In the case of 459 houses, or 72 per cent of the total number, the toilets are outside the buildings, usually at the rear end of the premises.

The 6-room house is the most common, 372 houses, or over 58 per cent of the total, being of this size. Of these 372 6-room houses, 164 have water and 68 have baths as well. None, however, have inside toilet accommodations. The range in monthly rental is from $5.50 up to $10, the average rental being $6.41 per month, or about $1.07 per room per month.

The second-largest group as regards number of rooms is that of the 8-room houses, of which there are 132, with rent varying from $10 to $20 per month. There are, however, only 4 houses in this group whose rental exceeds $13 per month. The average rental for these houses, all of which have water on both floors and bathrooms and inside toilets, is $11.72, or $1.47 per room per month.

These two groups (6-room and 8-room houses) represent about 80 per cent of the company houses and are the most representative as to type and rental rates.

The 636 company houses may also be grouped in a manner not shown in the table, viz, according as they are detached, semidetached (double), or built in blocks of four to eight units. The detached houses, of which there are 76, contain an average of 4.7 rooms, and the average rental is $5.20 per month. All of these houses are attractive and are on lots of ample size. There are 238 semidetached houses, having an average of 6.4 rooms. The average monthly rental is $6.93. The remaining 322 houses are built in blocks, the average number of rooms being 7, and the average monthly rental $9.53. The rent for the end or corner house of a block is $1 more than for inside houses. The average cost per month per room for the houses in these three groups is as follows: For detached houses, $1.10; for semidetached, $1.08; and for houses in rows or blocks, $1.36.

Since these rentals represent all the costs, there being no charge for water, garbage disposal, or cleaning toilets, the rental rates may be regarded as uniformly reasonable. A waiting list is kept, and as far as possible the wishes of employees are granted when they are desirous of removing to other houses which may be better suited to their circumstances. Leases are made direct with the employees. The articles of agreement have no clause of waiver of property rights for rentals, as rent charges are deducted from the employee's wages. There have been several cases where the dependents of an employee accidentally killed at the works have been allowed permanently to remain in the houses without paying rent or until children grew up and secured employment with the company.

No liquor is sold or allowed on the property of this company and a clause in the lease further prohibits the lessee from using any part of the premises for carrying on any business.

"SHANTIES" OF THE UNSKILLED WORKMEN.

The foregoing discussion of the housing policy of this company has embraced such of its houses as are provided for its skilled and semiskilled employees. These houses have been shown to be of a good type and to be maintained in good repair.

A very different condition exists in the housing of the large force of unskilled laborers, composed mainly of Negroes, Russians, and Hungarians. The steel company properly designates the abodes it provides for these men as "shanties." These shanties have long been fixtures at this plant and their number has been increased materially in recent years.

There are 337 shanties which are located in several groups near different departments of the steel plant. With the exception of 4, they are arranged in rows, with about 10 shanties to a row. The following description applies to practically all of these small shanties: Each is about 10 by 14 feet, with the comb of the roof 12 feet and the sides 8 feet above the floor. The construction is of ordinary rough pine 1-inch boards, weather-stripped on the outside. Similar material is used for the flooring, the floors being about 2 feet above the ground surface. The building is not ceiled. The roofing is either of shingles or tarred paper. The windows are small. The number of occupants varies with the productive activity of the plant. When the plant is operating with a full force, four men are allotted to a shanty, in which they eat, sleep, and do their cooking and washing.

The furnishings are primitive in the extreme. For sleeping purposes there are two 2-high bunks, the space between the lower and upper being slightly larger than required for a man of ordinary size to crawl in. The men provide not only mattresses and bedding, but also the stove and the fuel necessary for cooking and heating. If they do not desire to cook for themselves, meals can be had at reasonable cost in the several mess houses located among the several groups of shanties. These mess houses are not operated by the steel company, but the company exercises supervision over them as to charges and as to conduct. Some of these mess houses are operated by men employed in the company's office. The water for cooking and washing is obtained by the occupants of these shanties from outside hydrants. The company has recently installed a shower bath in a small house adjacent to the shanties, and all employees are privileged to use it. During the cold months, however, this permission is generally disregarded, because only cold water is supplied, although hot water could easily be furnished from a near-by mill, and with almost no expense to the company. The trash and garbage are removed daily by the garbage department.

Sometimes the end shanty of a row is a lean-to affair of still more flimsy construction than those described, of approximately the following dimensions: Twelve feet long, 7½ feet wide, and 7 feet high at the lowest part of the roof, 9 feet at the highest.

In one of the shanties of this size three men lived and did their cooking. The sleeping quarters consisted of the box-type bunk previously described, but in this case arranged all three in one tier. The lowest bunk was almost on the floor and the top bunk was only far enough below the roof for a man to crawl into it. The air space per man in this shanty was less than 240 cubic feet.

There are 23 rows of these small shanties, containing in all 225 shanties, for colored employees, and 11 rows, containing 108 shanties, for white employees.

In addition to the small shanties there are four buildings of similar construction, but larger, called "barracks," where in large single rooms a greater number of men can be crowded than in the shanties previously described. These "barracks" are occupied by white employees. A description of one of them is as follows: The building is 24 feet square, the comb of the roof being 12 feet from the floor and the sides 7 and 8 feet high. There are five windows, two on each side and one at the end opposite the stove. There are six panes of 10 by 12 inch glass to each window, but at the time of this investigation a number of the window panes were found broken. This shanty, in common with many others, is open underneath, and as the boards are not tongued and grooved there is no protection against the cold. At one end of the room is a cooking stove of good model, upon which all the cooking is done by the men themselves. The stove is far too small to heat the shanty in winter.

Near the door is a rough board table, with a bench on each side. Here the men eat their meals and read in the evenings. A number of rough bunks which are nothing more than boxes with rough legs nailed to them complete the furnishings. Six of the bunks are double width for two men and one is a single bunk. Nos. 1, 2, and 6 are arranged 2-high.

Seventeen men were occupying the shanty at the time the agents visited it. Some of its occupants stated that at times it had been occupied by as many as 20 men. Making no allowance for "furnishings," the bare room, when occupied by 17 men, would afford approximately 340 cubic feet of air per man, and when occupied by 20 men, a little less than 290 cubic feet per man. It will readily be understood that the air space above noted is very materially reduced by the 7 bunks and the 15 to 20 kit boxes belonging to the occupants.

The cost of construction at present prices for such a barracks would be approximately as follows: Lumber, $45; tar paper, $18; nails, glass, and sash, $7; labor, $30; total cost, $100—these being considered outside figures. This "barracks" when rented to 17 men brings in $1 per month for each man, or $204 per year. In other words, the capital cost would be replaced during the first year, together with an interest of 104 per cent on the investment, and every succeeding year an interest of 204 per cent.

A number of the men, both white and colored, were interviewed relative to the weatherproof conditions of the shanties, and these men stated that repairs were not kept up and that sometimes the shanties were wet and cold.

The 333 shanties and the 4 large shanties or "barracks" furnish quarters for about 1,375 men, the ordinary shanties in rows quartering 4 men each and the barracks 5 to 20 men each. For the use of these quarters the men are charged $1 each per month, so that the income from this source, which represents an outlay of less than $15,000, would be, when the plant is on full running time and all shanties occupied to capacity, about $1,375 per month, or $16,500 per year. The total monthly income from the rent of the houses and shanties combined is about $6,500 when all are occupied. Of this amount the shanties produce a little over 20 per cent, which fact may reasonably account for their continued use, notwithstanding the statement of an official of the steel company that the shanties are considered by the company as being far from desirable, and the fact that a former chief of its medical staff had during his incumbency registered protests against the shanties.

COMMUNITY B, EASTERN DISTRICT.

This community has been fully described under the title of "Community B," in the reports of the Immigration Commission, volume 8, pages 581 to 732, and consequently requires no attention here except with regard to the company houses, a subject which received very little space in the reports of that commission.

The following tabulated statement regarding its company houses was furnished by the steel company, and indicates in summary form the character of the accommodations. There are in all 189 houses, of which a few of the larger, or those commanding the higher rental, are occupied by salaried employees and are therefore omitted from the analysis of the table in order to adhere to the purpose of confining the discussion to conditions affecting the workmen.

DESCRIPTION AND RENT PER MONTH OF 189 HOUSES MAINTAINED BY A STOCK COMPANY IN THE EASTERN DISTRICT.

Number of houses.	Construction.	Number of rooms.	Rent per month.	Water in or out.	Water-closet in or out.	Houses, single, in pairs, or in rows.
1	Frame	16	$37.50	In	In	Single.
2	do	15	35.00	do	do	Do.
1	do	10	23.00	do	do	Pair.
1	do	10	20.00	do	do	Single.
1	do	9	22.50	do	do	Pair.
1	do	9	22.50	do	do	Row.
3	do	9	21.00	do	do	Pair.
10	do	9	20.00	do	do	Do.
3	do	9	15.00	do	do	Do.
1	do	8	13.00	do	do	Do.
1	Brick	8	13.00	do	Out	Row.
1	Frame	8	12.50	do	In	Pair.
1	do	8	12.00	do	do	Do.
1	do	8	12.00	Out	Out	Do.
1	do	8	12.00	In	do	Do.
7	do	8	12.00	do	do	Row.
2	Brick	8	12.00	Out	do	Do.
1	do	8	12.00	In	do	Pair.
1	Frame	8	11.00	do	In	Single.
2	Brick	8	10.00	do	Out	Row.
2	do	8	10.00	Out	do	Do.
2	Frame	7	10.00	In	do	Single.
1	Brick	7	10.00	do	In	Pair.
6	Frame	7	10.00	Out	Out	Do.
6	do	7	10.00	do	do	Row.
1	Brick	7	9.50	In	In	Pair.
1	Frame	7	9.00	Out	Out	Do.
8	Brick	7	7.75	do	do	Row.
3	Frame	7	7.50	do	do	Do.
1	do	7	7.00	do	do	Pair.
1	do	7	6.50	In	do	Single.
3	do	6	10.00	Out	do	Row.
3	do	6	9.75	do	do	Do.
2	do	6	9.25	do	do	Pair.
1	do	6	8.75	do	do	Row.
2	do	6	8.00	In	do	Single.
9	do	6	8.00	Out	do	Row.
1	do	6	8.00	In	do	Pair.
16	Brick	6	7.00	Out	do	Row.
6	Frame	6	7.00	do	do	Pair.
8	do	6	7.00	do	do	Row.
35	do	6	6.50	do	do	Do.
24	Brick	6	6.50	do	do	Do.
3	do	6	6.00	do	do	D0.
1	Frame	5	7.00	In	do	Single.
1	do	4	5.00	do	do	Do.

The four groups of houses, containing respectively 9, 8, 7, and 6 rooms, constitute 96 per cent of the whole number. There are 18 9-room houses for which the average monthly rental is $19.61, 21 8-room houses averaging $11.69, 30 7-room houses averaging $8.88, and 113 6-room houses averaging $7.03 per month.

On the basis of the rental rates per room, the 9-room houses show an average of $2.18 per month; the 8-room houses, $1.46; the 7-room houses, $1.27; and the 6-room houses, $1.17.

Houses of different types, including those with white tenants as well as those occupied by colored families, were visited by agents of the Bureau. Both the exteriors and interiors of the houses indicated that due care was exercised in selecting tenants and that the occupants kept the premises clean and orderly. The houses appeared to be in reasonable repair and compared favorably with houses of outside ownership in their respective localities and rented to steel workers. The rental rates are reasonable and the leases contain no burdensome provisions or the right to seize household property to satisfy arrears in rent.

Several instances were found where widows of employees were allowed use of company houses rent free.

Leniency in the matter of collecting rent is extended to employees who have been injured in the works, and agents found one instance where rent was remitted for a period of many months in the case of an employee injured while on duty. During the period for which the rent was remitted the family of the injured employee was given credit by a local store company closely allied to the steel company, and this bill, it is understood, was paid by the steel company. In another case, that of a widower who was killed in the steel works, leaving a large family of dependent children, the company allowed the family to remain in its house for a long time rent free, and furthermore kept the family provided with the necessities of life until the elder children were able to take care of the others. Other similar cases were cited by employees, but were not all corroborated by personal visits of agents.

COMMUNITY C, PITTSBURGH DISTRICT.

This community, which is to a large degree under the control of a steel company, has been adequately described in the reports of the Immigration Commission, volume 8, pages 329 to 490, under the title of "Community A." It seems desirable, however, to present some additional data relative to company houses.

The primary reason given by officials of this company for the erection of a number of company houses in scattered sections of the community was that such action was necessary in order to assure reasonable rental charges for houses of outside ownership occupied by its employees. This action was intended to serve as a preventive against excessive rental charges, the implication being that if these excessive charges were persisted in the company would build more houses for its employees.

There are 355 of these company houses, scattered through the several towns or villages in the neighborhood of one or another of the company's plants, and although they furnish homes for only about 3 per cent of the steel workers, it is claimed that their ownership and control by the company has had a salutary effect upon the rental rates of the houses of outside ownership.

In the accompanying table are shown the number and type of houses and a general description of the tenements as to number of rooms, conveniences, and rent charges.

DESCRIPTION OF 214 HOUSES (141 DOUBLE AND 73 SINGLE), AND THEIR 355 TENEMENTS, MAINTAINED BY A STEEL COMPANY IN PENNSYLVANIA, WITH RENT PER MONTH OF TENEMENTS.

Houses.				Tenements.					
Number.	Construction.	Cellar.	Basement.	Number.	Rooms.	Rent per month.	Water.	Water-closet.	Bath.
1	Frame	Yes	No	1	9	$16.00	In	In	Yes.
1	Frame	Yes	Yes	1	9	15.00	In	In	Yes.
1	Brick	Yes	No	2	9	12.00	In	Out[1]	Yes.
6	Frame	Yes	No	12	8	13.00	In	In	Yes.
1	Frame	Yes	No	1	7	25.00	In	In	Yes.
9	Frame	Yes	No	9	7	20.00	In	In	Yes.
1	Frame	Yes	No	1	7	18.00	In	In	Yes.
1	Frame	Yes	No	1	7	9.00	Out	Out	No.
1	Frame	Yes	No	1	7	8.00	In	In	No.
1	Plank	Yes	No	1	7	6.00	Out	Out[2]	No.
1	Frame	Yes	No	1	7	5.40	In	In	No.
4	Frame	Yes	No	4	6	10.00	In	In[1]	No.
2	Frame	Yes	No	2	6	9.00	In	Out[1]	No.
1	Brick	Yes	No	2	6	8.10	In	Out[1]	No.
7	Frame	Yes	No	14	6	8.00	In	In	No.
1	Frame	Yes	No	1	6	8.00	In	Out[2]	No.
2	Frame	Yes	No	2	6	8.00	Out	Out	No.
1	Frame	Yes	No	1	6	7.50	Out	Out[2]	No.
1	Plank	Yes	No	2	6	5.40	In	In	No.
½	Frame	Yes	No	1	5	12.00	In	In	No.
1½	Frame	Yes	No	3	5	10.00	In	In	No.
20	Frame	Yes	No	40	5	8.50	In	In	No.
7	Frame	Yes	No	7	5	7.00	Out	Out[3]	No.
2	Frame	Yes	No	2	5	6.00	In	In	No.
1½	Frame	Yes	No	3	5	6.00	Out	Out	No.
3	Frame	Yes	No	6	5	5.50	In	Out[1]	No.
2	Frame	Yes	No	2	5	5.00	Out	Out[1]	No.
1	Plank	Yes	No	1	5	4.00	Out	Out[2]	No.
3	Plank	No	No	6	4	12.00	In	Out	No.
3	Plank	No	No	6	4	10.00	In	Out	No.
1	Frame	Yes	No	1	4	9.00	In	Out[2]	No.
1½	Frame	No	No	3	4	8.50	In	Out	No.
1	Frame	Yes	No	2	4	8.00	In	Out[1]	No.
3	Frame	Yes	No	3	4	8.00	Out	Out	No.
1	Frame	No	No	2	4	7.50	In	Out	No.
10	Frame	Yes	No	10	4	7.00	In	In	No.
1	Frame	No	No	1	4	7.00	In	Out	No.
4	Frame	Yes	No	4	4	7.00	Out	Out[2]	No.
56	Plank	Yes	Yes	112	4	6.00	In	In	No.
1	Frame	Yes	No	1	4	6.00	In	In	No.
1	Frame	Yes	Yes	2	4	6.00	In	In	No.
1	Frame	Yes	No	2	4	6.00	Out	Out	No.
25	Plank	Yes	Yes	50	4	5.40	In	In	No.
1	Frame	Yes	No	1	4	5.00	Out	Out[2]	No.
1	Plank	Yes	No	2	4	4.05	In	In	No.
2	Frame	Yes	No	2	4	4.05	In	Out[2]	No.
6	Frame	No	No	6	4	4.00	Out	Out[4]	No.
4	Plank	No	No	8	4	3.70	In	In	No.
1	Plank	No	No	1	3	4.00	Out	Out[2]	No.
3	Plank	Yes	No	3	3	3.00	Out	Out[1]	No.
1	Plank	Yes	No	2	2	3.00	In	In	No.
1	Frame	Yes	No	1	2	2.00	In	Out[2]	No.

[1] One has no sewer connection.
[2] No sewer connection.
[3] Five have no sewer connection; vaults are cleaned every 2 years.
[4] Two have no sewer connection; vaults are cleaned every 2 years.

Of the 355 tenements, 73, or 21 per cent, are detached and 282, or 79 per cent, semidetached. The average number of rooms in the detached houses is 5.1, the average monthly rent per house $8.81, or $1.72 per room. The semidetached houses are cheaper. The average number of rooms is 4.5, the average rent per house $6.92, or $1.54 per room. It may be noted that the steel company does not charge water rent to its tenants, while other house owners do, and that the water rents in this particular vicinity are reputed to be high.

Over 50 per cent of the stock of the water company supplying water to the surrounding villages is owned by the steel company.

The lease to tenants provides tenure for one month from date thereof, provided that during such term or time the lessee remains in the employ of the company and obeys its rules for the regulation of tenants. It also provides that the rent shall be payable on the first day of each month and be deducted from the lessee's monthly wages, and empowers the company to collect from these monthly wages any damages assessed against the tenant for any violation of its rules. It also contains a waiver of property exempted by law and gives the company the right to distrain same for rent in arrears.

The following is a copy of the rules governing the company's house agent and tenants:

RULE 1.—The house agent will see that on delivering possession to a new tenant the premises are clean and neat, and in reasonably good order—and also leave with the tenant a copy of these rules or see that they are posted in a place where they may be readily noticed.

RULE 2.—The tenements of the company are for the use of the company's employees; and other persons shall not be admitted until they are first supplied.

RULE 3.—The house agent will admit no person as tenant who is known to be disorderly, quarrelsome, addicted to drunkenness, or in any way disturbing the peace, or who is not known or thought to be orderly and decent in his behavior.

RULE 4.—Each tenant shall, before entering upon the premises, sign a lease prepared by the house agent, in which he shall agree to be governed by, and strictly obey and observe, these rules.

RULE 5.—The following regulations must be strictly observed by all tenants: 1. The property, inside and out, must be kept clean and neat. 2. No pen or building shall be erected on the premises for the keeping of hogs, goats, cows, chickens, or any other animal or fowl. 3. No hogs or goats shall be kept on or about the premises. 4. No buildings or pens of any kind shall be built on the premises, and no alterations or changes shall be made on the premises without the consent in writing of the house agent of the —— Steel Co. 5. No fowls of any kind are to be kept in the cellar, or any other part of the house, and no pigeons are to be kept on the premises, nor any place for their shelter. 6. No ashes, dirt, or rubbish of any kind is to be thrown into the vaults, privies, or closets, and no tenant is allowed, under any circumstances, to place any ashes, dirt, or rubbish of any kind against the fences around the premises. 7. No tenant has the privilege of leaving any hydrant open and cause a waste of water. 8. The tenant shall procure and use upon the premises lime or other disinfectant when required to do so by the house agent. 9. Any damage done to the premises, such as defacing woodwork, walls, soiling paints, driving nails into the plaster, breaking glass, locks, doors, or other injury done in a careless manner and amounting to more than reasonable wear and tear, of which the house agent shall be the judge, shall be assessed by the house agent and paid by the tenant.

RULE 6.—The house agent will inspect monthly, or oftener, at his option, all such tenements as he may deem necessary, and shall warn the tenant of any violation of these rules. If the offense be a grave one, or is repeated after such warning, the tenant shall at once be removed in accordance with the agreement in his lease, of which these rules are a part.

RULE 7.—Each tenant desiring to vacate the house he occupies is required to give at least five days' notice to the house agent of his intention of doing so.

RULE 8.—Each tenant removing from a house will be charged full rent until he returns the keys to the house agent.

RULE 9.—Each tenant removing from a house after the second day of the month will be charged a full month's rent.

RULE 10.—No tenant is allowed to sublet any part of the house or premises without the consent in writing of the house agent.

Note that a tenant removing from a house will be charged full rent until he returns keys to the house agent; that each tenant removing from a house after the 2d day of the month will be charged a full month's rent; and that a tenant must give five days' notice of intention to vacate.

Company houses are in great demand and are seldom vacant, due to the moderate charges. A waiting list is kept of the applicants, and no house is rented until the house agent has investigated with regard to the applicant's care of the last property rented as well as his standing as an employee of the company. This method has resulted in securing tenants the most likely to give the best care to the property and become practically permanent tenants. In this matter of selection care is taken to rent to those who are likely to make congenial neighbors, a feature that the house agent pointed to with considerable pride. He mentioned a number of cases in which he had placed families of like religion in double houses to make conditions still more agreeable to them.

A strict supervision and inspection is maintained over the houses, complaints are promptly attended to, and proper repairs are made. Agents of the Bureau visited a number of houses in the different groups, and found the houses and premises well kept in all cases. The general appearance of many of the houses indicated that they had been built a number of years; but they showed careful use and were in excellent state of repair. The tenants had no previous notification of a coming inspection and the conditions observed may therefore be taken as an index of those prevailing at all times.

One large group of these houses is considerably affected by the conditions existing in two rows of noncompany houses, comprising 28 tenements of 4 rooms each, all occupied by employees of the steel works, but in which the steel company has absolutely no interest. These two rows face each other, separated by an open space about 60 feet wide. This space was utilized as the main dumping ground for all the ashes, dirt, filth, and garbage thrown out by 28 families, and the spectacle was revolting and nauseating in the extreme. The inhabitants, who were all foreigners, apparently accepted and contributed to these noisome conditions as a matter of course.

At the rear of the two rows ashes were piled fully 3 feet deep, mixed with daily additions of kitchen refuse and other offal. Between these rows of houses and at the ends of the open space there were counted 42 empty beer kegs. Inside these houses, poor furnishing and abject squalor and dirt was the prevailing condition. In one case an attempt at cleaning was in evidence. A barefooted woman was pouring water on the floor and washing it out with a broom. A number of children were playing in the open space on the dirt piles under a network of clotheslines hung with drying clothes. These foul, disease-breeding conditions are a constant menace to every one of the occupants of the company's houses in the neighborhood and are otherwise a public nuisance. The steel company admittedly is able to control such conditions through its ability to bring pressure to bear upon the local officials and upon the business men who own these filthy houses. The reply of the company officials to inquiries why these conditions were allowed to remain was that local political reasons made it undesirable to attempt to force the houses to be cleaned up or destroyed.

COMMUNITY D, ALABAMA.

This community, which is in a general way typical of the company communities of the South, has been built up around one of the large steel plants in Alabama.

In this community there were 769 houses owned by the company, of which number 499 were allotted for occupancy by employees of the manufacturing departments, and 270 for employees engaged in mining. At the time of the investigation only about 414 of the 499 houses allotted to the steel workers were rented.

The company has furnished a statement applying to all of their 769 houses, which shows that the average rental paid by the tenants in the houses occupied August, 1910, was $2.35 per room per month. Real estate values are very low in this district, and this rental rate is consequently very high. The average rate per room in the Pittsburgh district in 1908 was $2.58 as determined by the Immigration Commission (vol. 8, p. 287).

There are no available houses in the neighborhood of the plant other than those owned by the company. The nearest city is quite a distance from the plant and employees would be obliged to add street-car fare to the expense of living.

Furthermore, a great inducement to employees to rent houses from the steel company lies in the fact that in the event of employees being laid off on account of slack work, those who are tenants of the company are not evicted and are given reasonable time to pay up back rent after returning to work. The quarters are so near the plant that in many cases furnace employees may go home during the long rest periods of their shift.

The houses are all rented under a lease which, in common with many of the lease forms used in the South, contains certain noteworthy provisions. The most important of these gives the company control over any visitors obnoxious to it whom the family may receive. This control is gained through a clause in the lease giving the lessor the right "at any time to forbid ingress and egress over adjoining premises to reach the leased premises to any or all persons other than the lessee and members of his family living with him."

It may be further noted that although wages are paid only semimonthly at this plant, and so long after the end of the pay-roll period that it would be on the average about 25 days after a man began work before he would be paid, it is stipulated in the lease that rent is payable monthly in advance, and that the company retains the right to evict on one day's notice in case the tenant leaves the company's service.

On account of these and other interesting features, a considerable extract from the lease is quoted here:

> Lessee agrees to pay to lessor rent for the said premises at the rate of......dollars per month, payable in advance on the first day of each calendar month, which lessor shall have the right to deduct from any wages due from it to the lessee. This lease is entered into by lessor because of the employment by lessor of lessee; and if lessee should at any time hereafter be discharged from the service of the lessor, or voluntarily quit the service, in either of said events lessor shall have the right to reenter upon and take possession of the leased premises upon one day's written notice to vacate said premises, either given to the lessee in person or by leaving same upon said leased premises. Upon such termination of the lease, lessee shall only be liable for rent to the date of its termination, and if rent has been collected beyond that date it shall be refunded to the lessee.
>
> Necessary ingress and egress over the adjoining premises of the lessor to reach the nearest public highway is hereby given to the lessee and members of his family living with him. A way of ingress and egress may, however, be designated by the lessor to the enjoyment of which lessee and his family will thereafter be restricted; and the lessor may at any time forbid ingress and egress over adjoining premises of the lessor to reach the leased premises to any or all persons other than the lessee and members of his family living with him.
>
> This lease can not be transferred, nor can any subletting be had of the leased premises without the consent in writing of the lessor; and upon any transfer or subletting of these premises without such written consent, the lessor may forthwith cancel this lease and reenter upon said premises.

The company houses are located on a tract covering about 100 acres of hilly land, too poor for gardening. The white employees are segregated from the Negroes by two wide thoroughfares.

WHITE QUARTERS.

The white quarters are arranged so as to segregate the different nationalities (Americans, Greeks, Poles, and Italians) into sections or rows. Only one street was inhabited by Americans, and these were families of watchmen and policemen employed at the steel plant. The streets are well lighted at night by arc lamps.

The houses are located about 25 feet apart on wide streets or roads and are raised 4 or 5 feet above the ground. All are well-built, one-story frame houses, perfectly square. There is a front porch running the full width of the house and a small porch at the back. Each house contains 4 rooms and is what is known as a double or two-family house. The front rooms are 14 by 16. Those in the back of the house are somewhat smaller. The rooms are ceiled but not plastered, and the flooring is of matched stock in fair condition. Each double house has a hydrant at the back door and an open brick drain to carry away waste water.

Connected with each 2-room apartment is a water-closet that is connected with the city sewerage system and automatically flushed. In addition these closets are flushed every Saturday by the company and powdered with disinfectant to keep them in good sanitary condition.

Among the houses visited it was found that the typical family, consisting of a man, his wife, and two children living in 2 rooms, would generally use the front room as a bedroom, usually with three beds. In some houses a fourth bed was placed in the back room or kitchen. The front rooms, with three beds and the other furniture, were generally greatly overcrowded.

All Greeks who are without families are housed in bachelors' quarters, where they rent a single bed from the "boss Greek," who in turn rents the houses from the company. These bachelors furnish their own bedding. All that is provided for them is a single bed or cot, of which there are three in each room. This is the limit fixed by the company. These men get their meals at a Greek restaurant on the premises. In a general way this describes the manner of living of all the single immigrant workmen.

The rent of these houses, including water, is $10 per month for those of 4 rooms and $5 per month for those of 2 rooms. The company furnishes a trash barrel and the tenants are expected to place all waste matter therein and generally to keep the premises clean. If the premises are not kept clean the tenants are first warned, and if they disregard this warning, the company cleans up the premises and charges the tenant from 35 cents to $1, according to the time spent in cleaning.

The company posts the following notice on each house:

NOTICE.

Persons occupying these premises are requested to keep the buildings and grounds in a clean, sanitary condition. All trash, rubbish, weeds, papers, etc., must be placed in barrels or cans or collected in piles to be carried off by sanitary men. Closets must be kept clean.

Tenants failing to comply with this notice will be charged for the labor necessary to put places in proper condition, and upon further neglect will be prosecuted under the law.

NEGRO QUARTERS.

The Negro quarters are located on a rugged hillside, and the so-called streets are almost impassable.

The quarters are composed of single and double (two-family) houses. All are poorly constructed and show much wear. The single houses are weatherboarded outside. The front room, which is about 16 feet square, is ceiled but not plastered. The back room is much smaller and has a small shed room attached. These houses have a porch running the full length of the front.

The double or two-family houses contain 4 rooms. These are better constructed than the single houses, with larger rooms and a back porch. The Negro families were not crowded to so great an extent as the white families. The homes of the Negroes, as a rule, were fairly neat and clean.

The Negro quarters are unlighted at night, except by the flare from the open-hearth and Bessemer departments of the plant.

The tenants are compelled to go from 75 to 200 feet for water, according to the distance of their houses from the nearest hydrant. The tenants complain bitterly against this hardship, for in most cases the water must be carried up a steep hill. Each hydrant supplies on the average four houses. The monthly water rent per family is 25 cents, so that the company receives an average rental of $1 per month for each hydrant.

There is no sewerage, either open or closed, for the waste water from these houses. The water runs down into the street and is dried up by the sun and air.

The privies are located about 75 feet from the houses. The company looks after their sanitary condition and keeps a man continually employed at this work. Each privy is supposed to be cleaned once a week, but the service is irregular. At the time of the agents' visits the odor from this source was very objectionable.

Pigs, cows, and fowls run at large on the thoroughfares. The company objects to this, but the tenants assert it is only in this way that they are able to supply themselves with fresh meat, particularly in the winter when meat prices are high.

The single houses of 2 rooms, with shed attached, rent for $3 per month. In the double houses 2 rooms rent for $4 and 4 rooms for $8 per month. In all cases this is exclusive of the water charge of 25 cents per month. This rent, including the charge for water, is somewhat lower than in the white quarters, but the houses and general accommodations are much less desirable and the location is a particularly bad feature.

COMMUNITY E, GREAT LAKES DISTRICT.

The general conditions of this community have been fully considered in the reports of the Immigration Commission, volume 8, pages 733 to 807. In that report, however, only the principal features of the housing situation were given.

This community is of interest chiefly because the steel company at the time of erecting its plant gave no thought to the housing of its employees, but later, after a community of miserable hovels and cheaply constructed tenements had grown up, turned its attention to the subject. It has erected a number of reasonably good dwellings, which are rented at moderate charges, and has also done much to improve the community generally.

The houses which the company constructed are in two sections, or villages, one of which is of comparatively recent establishment, while the other has been founded many years. There are in all 575 company houses.

In the new village, which is peopled chiefly by American foremen and highly skilled workmen, there are 125 company houses of three different types: (1) Detached frame houses with 8 rooms and bath, heated by hot water; (2) semidetached frame houses with 7 rooms and bath, heated by hot water; (3) brick tenements of two stories, with 7 rooms and bath, heated by stoves. There are 15 of the detached houses, the monthly rental of which is $19.50, or $2.44 per room; 50 of the semidetached houses, renting for $16.50 per month, or $2.36 per room; and 60 of the brick tenements, each renting for $12.50 per month, or $1.79 per room. Electricity and water are included in these rental rates. All of these houses have large cellars, lined with concrete, with separate drainage for each cellar, and all have inside well-flushed closets, the sewage of which is carried by closed drains to a sewage disposal plant.

The houses rent at reasonable rates and are well kept and in good repair. Their location, however, is not good. Only the spots upon which the houses are built are raised up to grade, leaving large depressions between the houses in which water stands all the time.

In the older village there are 450 company houses. The occupants of these houses are largely married foreigners, but include a number of American families and some Negroes. The houses are of brick with slate roofs, and each house has a front parking of 25 feet and a garden about 50 feet deep. The roadway is 30 feet wide. The houses are maintained in good repair, and the streets and alleys are cleaned by the company without cost to the tenants. A covered garbage can is furnished with each house. The houses are heated by stoves and lighted by lamps.

The houses are of two types, 4-room and 5-room, the former renting for $6 per calendar month and the latter for $7.50. The rent includes the cost of water.

The 4-room houses are of two stories and are arranged as follows: First floor, front, a living room 12 feet square, back of which is the kitchen, 11 by 16 feet, containing a sink with cold water. Opening off the kitchen is a small, flushed water-closet. A cellar extends completely under the house. It is cement lined and floored, although the floors are not always in good repair. At the back of the cellar is a cement lined open drain, which passes along an entire row of houses and carries off the water when the cellar is washed out or when the entire row is given a flushing, which is done once a month. On the second floor are two bedrooms, of the same size as the rooms on the lower floor.

The 5-room houses are also of two stories. The first floor has a living room 12 by 15 feet, back of which is a kitchen 16 by 13 feet, which contains a sink. Back of the kitchen is a pantry about 7 by 5 feet, and a flushed water-closet about 5 feet square. On the second floor in front is a bedroom 12 by 15 feet, with a closet opening off of it. Back of this are two smaller rooms, which are also used as bedrooms. The cellars are similar to those of the 4-room houses.

Houses of either size are rented at reasonable rates, and so far as interior accommodations are concerned they are fairly comfortable homes. Outwardly, however, the houses are exactly alike, and being constructed in very long rows present a somewhat monotonous and dreary appearance. There are no trees on either street except a magnificent elm, of some 60 feet spread, which stands as evidence that trees, which would do much to make the whole section more comfortable as well as attractive, would grow if planted. There is a poor grade of coarse grass in many of the yards, but the made ground on which most of the houses stand does not favor the growth of lawns.

The tenants occupy the houses on a month-to-month lease at the sufferance of the company, which reserves the right to evict them at any time for any reason. Rents are not paid in advance but are deducted from wages. The company's men inspect all the houses at least once a month, and in case a house is found to be dirty the occupants are ordered to clean it up. If the cleaning is not done in three days the family is given notice to find other quarters. Evictions for this reason are not frequent now, but in earlier years were very common.

COMMUNITY F, GREAT LAKES DISTRICT.

All of the constructive work of the steel plant in this community was completed within five years, and in order to have dwellings ready for the workmen by the time the plant was to be put in operation it was necessary for the steel company to take some part in the development of the town. Under the laws of the State it was necessary to organize special subsidiary corporations to handle the real estate and to furnish heat, light, and water. The following pages present a study of the results accomplished by these companies.

In the planning and building of this city everything was subordinated to the steel plant. The steel plants which have already been erected stretch along the lake front for several miles, without a break which would allow the people to get to the water front. There is consequently no park on the water front and no possibility for one within reasonable reach of the city, even if it becomes the great industrial city that its builders hope.

In many ways this community is possessed of great advantages. While the city is laid out entirely on the rectangular system, and suffers in appearance thereby, it profits greatly from the fact that a definite town plan was followed from the start. The city is well paved, well drained, and is provided with a lighting and water system. The schools are well housed and thoroughly equipped. The new Y. M. C. A. building is a great asset to such a town, where unmarried men form so large a part of the community.

As a result of the rapid growth of the town real estate prices have advanced greatly, and this has affected the rates of rental. The chief beneficiary of this rapid increase of land values has been the above-mentioned land company, which owns all the land in the immediate neighborhood of the steel plant. The result of the high real estate prices and rentals has been that a large part of the population, particularly the unskilled laborers, are living a long distance from the plant in poor and badly crowded accommodations.

The greatest problem at —— was not the engineering problem of building and equipping the tremendous plant, but of securing and maintaining an efficient labor force. On the testimony of officials and workmen, who are in the best position to judge, the greatest obstacle to maintaining such a force has been the high rental charges. The semiskilled workmen who desired and could afford a 4-room cottage at from $8 to $10 a month finds that he can not get what he wants at less than $12 to $16. The unskilled workman can afford nothing except poorly built and much congested quarters at some distance from the plant. The skilled workmen can get good accommodations, but the high rent brings his earnings down to a lower sum than he can get in the other "steel towns" to which he is accustomed.

The land company has profited greatly from the rapid appreciation of real estate and from the high rents. The heat, light, and water company has profited largely from the high rates charged for gas, water, and electric lights. It is doubtful, however, even from a financial standpoint whether the profits of these companies have compensated for the great difficulties under which the operating officials of the steel company have labored in attempting to create an efficient and stable force to operate the plant.

The land company in the spring of 1906 commenced the erection of houses for the occupancy of the steel workers and the employees of the railroad which connects —— with near-by communities. At the time of the investigation (April, 1911) 506 houses had been completed, 90 of which were allotted for the use of the railroad employees.

The number of employees of the steel works renting houses from the land company is 376, and about 13 per cent of the total force live in these houses. About one-fourth of the employees of the steel works live in adjoining towns, some at quite a distance, railway and street car connections making this possible. The other employees live in ——, or on its outskirts in houses owned by individuals or real estate companies not connected with the steel company.

The houses owned by the land company are as follows:

One 2-story 12-room brick and cement house, with furnace heat, bathroom, closet, and cellar, occupied by the general superintendent. The rate of rental is not listed on the rental rolls.

One 3-story 11-room brick house, with steam heat, bathroom, closet, and cellar, occupied by the property agent of the land company. The rate of rental is not listed.

Forty 2-story, 8-room brick and cement houses, each with furnace heat, bathroom, closet, and cellar. Rent, $30 per month. Each of these houses has a yard frontage of 45 feet.

One hundred and ninety-four 2-story, 6-room brick and cement houses, each with furnace heat, bathroom, closet, and cellar. Of this number 109 rent for $22.50 per month, 60 for $25 per month, and 25 for $27.50 per month, the higher rent being paid for the houses more conveniently located and for corner-lot houses.

Twenty 2-story, 5-room brick and cement houses, each with furnace heat, bathroom, closet, and cellar, renting for $20 per month.

Ten 2-story, 5-room concrete houses, each with bathroom, closet, and cellar, renting for $20 per month.

One hundred and twenty 2-story, 6-room frame houses, each with furnace heat, bathroom, closet, and cellar, renting for $18 per month each.

Thirty 2-story, 5-room frame houses, each with furnace heat, bathroom, closet, and cellar, renting for $17 per month.

Forty 2-story, 4-room frame houses, each with furnace heat, bathroom, closet, and cellar, renting for $16 per month.

Fifty frame houses of 1-story and a basement, each with 4 rooms and a closet. Bathrooms were originally provided, but the occupants used them for coal bins, so the fixtures were removed. Eight of the houses rent for $12 per month and 42 for $10 per month. Each of the above houses has a yard frontage of 30 feet, and is set well back from the street.

An examination of rental lists of real-estate brokers shows that the houses of the land company are rented at lower rates than similar houses not controlled by the land company. Frame or brick and stucco houses of 7 or 8 rooms on the lists of independent real-estate companies rent for from $35 to $40 per month; frame houses of 6 rooms with all modern improvements, $30 and $35; frame, 6 rooms, no modern improvements, $20; frame, 5 rooms, no modern improvements, $18.

The average size of the rooms in the 4-room frame houses is 15 by 12 feet. In the earlier occupancy of these dwellings between 50 and 60 people were sometimes crowded into the four rooms. In order to remove the resultant filth, it was necessary for the land company to turn a fire hose into the rooms to clean up the floors and wash down the walls. Following this experience the land company limited the number of occupants of these tenements to four persons per room, or 16 to a tenement. The house inspector had great difficulty in keeping the number at this limit and in securing sufficient cleanliness in the care of the rooms. Consequently, as most of the buildings needed cleaning up, and the rule as to the limit of occupants was constantly broken, the land company in March, 1911, decided to order all the tenants to move. This was done, and after the buildings had been cleaned and repaired a new rule was issued April 1, 1911, limiting the number of tenants to 2 persons to a room or 8 persons to a tenement. None of the former tenants was allowed to rerent, as it was believed that with new tenants the two-persons-to-a-room rule could be better enforced. The limit to two persons to a room applies also to the 5-room houses of the company, experience having shown that the 4 and 5 room houses are likely to be occupied by tenants who are inclined to overcrowding.

Immigrant tenants are given a prize of $5 per year for the best kept tenement, $2.50 for the second, $1.50 for the third, and $1 for the fourth.

For the best kept lawns the land company gives two prizes each year to be competed for by its tenants—a first prize of $25 and a second prize of $15. In addition to this, as an inducement to keep the lawns in good condition, the company furnishes free water for sprinkling purposes.

The houses above described are all located in what is known as the first subdivision, a territory of 800 acres, directly under the control of the land company. This subdivision, which has a frontage of 24 blocks, includes all the land directly in front of the steel works, so that if employees desire to be near their work they must necessarily live in this district. Within this subdivision the number of saloons is restricted to two, one at the hotel and one connected with a restaurant, both of which are high-grade establishments.

The deeds under which land or land and buildings are conveyed contain this clause: "The seller and purchaser herein mutually understand and agree for themselves and for their respective heirs, successors and assigns, that the seller herein made and adopted said ——— Land Co.'s first subdivision and established the building line as shown on the plat thereof and barred the manufacture, sale, or disposal of intoxicating liquors upon any of the lots in said subdivision, except those lots marked 'Use unlimited' [the two places referred to as having liquor license] on said plat for the benefit of itself, and also for the benefit of the owner of each and every lot in said subdivision from time to time, whether such owner be the seller or any other person or corporation."

The deed then provides as to the location of the building, and further stipulates that no intoxicating liquors shall be manufactured, sold, or otherwise disposed of on the premises therein agreed to be conveyed. Leases renting land or buildings are equally as strict as to intoxicating liquors.

The land company in constructing houses did not provide anything like a sufficient number of houses which were within the reach of the majority of workers in the steel plant, the unskilled laborers, on the basis of the wages which they are paid. There are only 42 houses which can be considered as available for this class of workmen, of whom the plant normally has 3,000 or more. Since proper accommodations were not furnished, many of the unskilled laborers are housed under very bad conditions. For example, in the second subdivision, with a population of 10,374 in 1910, is located a tract that is commonly known as "the patch," which is about 1½ miles from the steel works. "The patch" is not owned or controlled by the land company or by any subsidiary of the steel company, nor is the steel company financially interested in the houses erected in this particular locality. In and around "the patch" the majority of the unskilled laborers live. In 1910 there were not fewer than 206 saloons in this district.

In this second subdivision the rents charged by the individuals and real-estate companies who own the houses are very high; 4-room houses with no cellars or modern improvements rent for from $10 to $15 per month, and practically all houses of more than 5 rooms are rented only as boarding houses. In the neighborhood of "the patch" there are 22 flat buildings of two stories that have nothing but studding and plain boards on the outside and boards on the inside with no sheathing or plastering. These buildings, which rent for $10 per month, have no water or sewerage. They were put up as a speculation and at first proved a good investment, but of late they have not been fully occupied and the tenants do not as a rule remain long.

The land company has considerable land in the second subdivision which as yet has not been improved or built upon. Squatters have put up shacks on some of it, as well as on land not belonging to the company. A great many of these squatters have been removed, or have moved of their own accord. In 1910 the company prohibited anyone from erecting any building on its land without its permission—and very few permits are given.

As an instance of the conditions under which the common laborers in this community live may be mentioned the conditions existing in a story-and-a-half wooden building which was originally constructed as a police and fire station. On the first floor were 2 rooms, in each of which there were crowded 16 beds arranged in two rows with a narrow walk between. Upstairs there was a small room which contained 6 beds. The boarding-house boss stated that two men slept in each bed and that each man paid him 75 cents per week for lodging. There were consequently living in the three rooms of this small building 76 laborers, who paid to the landlord $57 per week, or $247 per month, for a sleeping place in this house which rented for only $25 per month.

The heat, light, and water company, a subsidiary company of the steel company, was established in 1907. The company charges for gas $1.10 per 1,000 feet gross, $1 per 1,000 feet net, i. e., if paid within 12 days.

For electric lights it is provided that the charge for the current furnished to any one customer shall not be less than $1 per month, and the rates are as follows:

If not more than 50 kilowatt hours are used in one month, 11 cents per kilowatt hour.

If more than 50 kilowatt hours are used in any one month, for the next 25 kilowatt hours 10 cents per kilowatt hour.

If more than 75 kilowatt hours are used in any one month, for the next 25 kilowatt hours 9 cents per kilowatt hour.

If more than 100 kilowatt hours are used in any one month, for the next 200 kilowatt hours 8 cents per kilowatt hour.

If more than 300 kilowatt hours are used in any one month, for all in excess thereof 7 cents per kilowatt hour.

Provided, that if the customer pays for electric power so furnished on or before the 12th of the month following that in which power is furnished a deduction of 10 per cent will be allowed.

The water rates are as follows:

For the first 20,000 gallons per month, 30 cents per 1,000 gallons. For the next 130,000 gallons per month in excess of the first 20,000 gallons per month, 10 cents per 1,000 gallons. For all in excess of 150,000 gallons per month, 6 cents per 1,000 gallons. It is provided that the charge for installing meter and furnishing water through meter shall not be less than $9 per year.

COMPANY HOUSES IN SMALL ISOLATED COMMUNITIES.

Communities A to F, hitherto described, are large towns in which the steel industry is dominant and in which the steel companies have taken an active interest in the housing of their employees. Communities G to K, which remain to be described, are examples of similar conditions in small isolated towns. As these small isolated towns are for the most part in the South, the examples are taken entirely from that district.

COMMUNITY G, ALABAMA.

This village, with a population of about 2,000, is composed entirely of company houses, the property of a large blast-furnace plant. The American white employees occupy two streets located on one side of the village. The houses on two or three of the adjoining streets are occupied by Italians and Negroes. The remainder of the village is composed entirely of Negroes. With the exception of the section occupied by the whites, the village is almost entirely without grass, and hogs are allowed to run at large.

The houses occupied by the American white employees are, as a rule, neat 2-story buildings, which rent at $10 to $15 per month. The streets are wide and the houses are 20 or 30 feet apart. The majority of the other houses, however, are square 1-story buildings containing 2 tenements of 2 rooms each, for which a comparatively high rental is asked. These are frame houses, weatherboarded, painted outside and ceiled inside. Each house has a porch. Most of these houses rent for $2 per room per month. Some of the poorer houses are single-tenement houses of 2 rooms, weatherboarded and painted but not ceiled. These rent for $1.50 per room per month. Each of the tenements has a combined coal shed and privy. The latter is cleaned by the company about once a fortnight.

The water supply of the village is inadequate. Hydrants of water marked "for use only in case of fire" are numerous. Notwithstanding this notice, the water from these hydrants is freely used for washing purposes, although it is not fit for drinking. Drinking water is obtained from springs or wells, of which there are only four or five in the whole village. From one of these springs the water is piped to three or four hydrants in the better part of the town. Many families are obliged to carry water 100 to 200 yards, and some as far as a quarter of a mile.

The houses occupied by whites are leased. The lease provides for eviction upon one day's notice, but this power is never exercised except in the case of discharge from the company's employ. Houses occupied by colored families are not leased but rented by the month.

COMMUNITY H, ALABAMA.

In this community there are two groups of houses owned by the steel company. Each group is located in the immediate neighborhood of a blast furnace, close up against immense slag piles on which hot slag is being constantly dumped. The houses are all 1-story frame buildings, with either 2 or 3 rooms. The buildings are weatherboarded and ceiled but not plastered, and all are in very bad condition. Some of them are fully 25 years old, and were originally of poor construction. The water supply is very limited, averaging about 1 hydrant to 8 houses. The water is obtained either from hydrants or from an old well, which was without a windlass at the time of the investigation. In some cases the tenants are compelled to carry water from 50 to 200 feet. The houses are all provided with dry closets, which are cleaned by the village, but the cleaning is done only once a month. Garbage is removed by the village, and no extra charge is made for water. The houses rent for $1.50 to $1.75 per room per month. This is very high considering their condition and location.

COMMUNITY I, TENNESSEE.

In this community the company operating the blast furnaces owns 110 houses located in a large oak grove. The community is unusually well laid out. Nearly every lot has on it one or more oak trees and a grass plot, besides a garden of both flowers and vegetables. The view from most of the homes includes a range of mountains, less than a mile distant. About 60 per cent of the employees of this company are quartered in these houses. Most of the houses, with the exception of those containing only 2 rooms, are well built and are weatherboarded and plastered. Each of the houses has a front porch, and is in every respect a comfortable home. All the lots are inclosed with a neat board fence, which is kept in repair and whitewashed by the company.

Each house is provided with a hydrant in the yard; the better class of houses also have a supply of water in the house. The charge for water is 40 cents per month in the case of the 2-room and 3-room houses, and 50 cents per month for the larger houses. The tenants look after the removal of their garbage. The water-closets, each of which is at the end of the garden and has a pit 5 or 6 feet deep, are cared for by the company and are kept in good condition.

The rents are unusually low—the 3-room houses generally renting for $3 per month and the 4-room houses for either $4 or $5 per month, according to condition and size of the lot. There are a few 6-room houses renting for $7 per month. The cheaper houses, which contain 2 rooms, are rented chiefly by colored employees for $1.50 a month.

COMMUNITY J, TENNESSEE.

A company operating a blast furnace in this community has 56 houses, which are occupied by about 80 per cent of its employees. These houses are rented by the month without lease, but tenants are subject to eviction on a week's notice when discharged from the company's service. All houses for which a rent of less than $6 a month is charged, and these comprise over 80 per cent of the whole number, were found to be old and dilapidated, with no evidence of ever having been repaired. They are miserable shacks, unsuitable for habitation. There are many holes in the walls and cracks in the floors, and the windows and doors are badly fitted. Those houses which rent for $6 and upward are ceiled and somewhat more comfortable.

The water supply is from springs, and each spring supplies water for families living in from 12 to 25 houses. Water has to be carried over 100 yards in some cases.

These houses are generally located on lots about 40 by 100 feet. The yards and premises were generally neglected and untidy. The company does not offer prizes for well-kept yards.

All of these houses except four are of 1, 2, or 3 rooms each. In view of the dilapidated condition of the smaller houses the rents are very high. Those of 1 room rent for $1 per month. The greater number of those of 2 rooms rent for $3.50 and the 3-room houses for $5 and $6 per month.

COMMUNITY K, VIRGINIA.

The blast furnace company in this community has 146 houses in which 75 per cent of its employees are quartered. These houses are all frame, of 3, 4, or 5 rooms each. All are weatherboarded. The 3-room and 4-room houses are ceiled, while those of 5 rooms are plastered. Each house has a small covered porch and a well-fenced yard about 40 by 50 feet. Nearly all of the tenants cultivate vegetable gardens, some keep poultry, and a few have cows and pigs.

The water supply is from hydrants and wells, but the water must be carried from 20 to 100 feet. The water-closets and the garbage and refuse are looked after by the company. The houses are rented without lease and there is no record of an employee ever having been evicted. They generally leave the premises shortly after being discharged from the company's employ.

The 3-room and 4-room houses rent for $1 per room per month and the 5-room houses for $1.25.

COMPANY STORES.

In the course of this investigation a study was made of 24 company stores connected with steel plants having a total of 39,123 employees.

In 17 of these 24 cases the steel company directly owned and operated the store. In the other 7 cases the control was indirect, the store being separately organized but its management controlled by the steel company through some such means as the mutual ownership of stock.

The company store is most frequent in the Southern district, where the isolation of many of the steel companies offers opportunity for the establishment and maintenance of such an institution. Of the 24 establishments in the Southern district for which data on this subject were obtained, 16 owned and operated stores. Outside of this district few steel companies have a financial interest either direct or indirect in the operation of stores.

The usual reason advanced for the establishment of such stores is the necessity of providing food, clothing, and other necessaries to the men coming into isolated localities. Behind this reason, however, lies the fact that these stores serve as an important factor in the economic management of the manufacturing business. They secure to their owners the absolute certainty of profit, by reason of the fact that the store orders with which the goods are purchased invariably represent money earned and, therefore, represent cash. The greater the proportionate amount of such store orders to the amount of the pay roll the less actual cash is required for circulation in the manufacturing department. Store profit really amounts to a decreased wage element in the cost of production.

It is invariably disclaimed by the proprietors that employees are compelled to buy at company stores, but when the system of monthly payment prevalent in the Southern district is considered, together with the delay of anywhere from 10 to 20 days intervening between the termination of the pay-roll period and pay day, it will readily be seen that it is very difficult for the ordinary workman to provide himself and his family with the necessaries of life without resorting to the use of store orders.

In many of the southern plants it was found that after the deduction of the company store bill, the company house rent, as well as the arbitrary fees deducted for medical service, insurance, etc., there was such a trifling sum remaining to be paid in cash that many of the workmen were practically compelled to remain in the locality. In some of the localities workmen were found who had had only a few dollars in cash for six months or more. Since there is seldom another steel plant in the community such men are practically obliged to continue in the same employment, unless they can secure a job with some establishment that is willing to pay their railroad fare and advance them a few dollars for immediate expenses.

The system employed in conducting company stores is practically the same, wherever operated. The usual plan is to issue "scrip," "store orders," or "O. K. slips." The method of procedure when a workman desires goods from the company store is for him to secure a proper certification of the wages due and present this statement to the person authorized to issue store orders. These orders are good only at the company's store or stores and are usually non-negotiable. The amount of these orders is charged against his pay.

In the Southern district, 3 companies reported that it was their custom to cash their store orders at the rate of 75 cents on the dollar, and 4 companies, one being an affiliated company, reported that they cashed such orders at 80 cents on the dollar. This means that an employee desiring cash between pay days may convert his store order into cash at a discount of 20 to 25 per cent in lieu of receiving a cash advance at par value. It should be noted that these orders are issued only for wages that have actually been earned.

Nine of the 16 companies operating stores in the Southern district supplied data giving the total amount of a normal pay roll and the amount of store-order deductions therefrom. In each case the pay-roll periods were monthly, and the length of time that elapsed between the end of the month and the following pay day varied as follows: In 3 establishments, 10 days; in 1 establishment, 12 days; in 1 establishment, 15 days; in 2 establishments, 20 days; 1 establishment gave the time as between 10 and 15 days and another as 18 to 20 days. The total elapsed time between the earning of the first day's wage and the receipt of payment for it, therefore, ranged from 40 to 50 days. All of these establishments were of comparatively small size and practically all wages were day rates, so that the time actually required to make up the pay roll should not at most exceed two days.

In the case of 3 of these 9 establishments the amount of store orders amounted to 50 per cent or over of the total amount of the pay roll. The other 6 ranged from 39 down to 16 per cent. Taking the total amount of pay rolls and store orders of these 9 establishments as basis for computation it is found that the average deduction for store orders alone is a little over 20 per cent of the amount of the pay rolls. This does not by any means represent the full proportion of the amount of the pay roll from which the companies derived profit through their company stores, because a considerable number of the employees deal at these stores and pay in cash.

While generally the store orders are not negotiable in form they frequently become so in practice through a custom that is quite common among the colored employees in the Southern district—that of obtaining a supply of goods from the store by means of these orders and then selling the goods at a discount in order to obtain cash between pay days.

In none of these stores were goods generally sold at lower prices than those of competitors, although there were cases where the company stores sold a few articles cheaper. The prices reported for meats and for such groceries as are not put up in packages were generally above those of competing stores, while for canned goods, tobacco, cloth, thread, etc., they were practically the same. One company sold its goods at prices ranging from 10 to 33 per cent higher than those quoted by competitors, and it is significant that in this particular case the percentage of store orders was the lowest reported.

These stores operate under the most favorable mercantile conditions possible. Backed by the credit of the steel companies, they are enabled to purchase goods in larger quantities and at lower prices than is the case with their competitors, and as their sales are for cash or store-order accounts which are collected through their own offices monthly they have practically received cash for the goods before they pay the wholesale jobbers for them. Furthermore, they sustain no loss from bad accounts. Thus at both ends of the transaction they have a distinct advantage which would enable them, if so disposed, to undersell their competitors and still make a fair profit. Instead of this, the prices on most of the food staples range as high or higher than those at the outside stores.

While it was impossible to secure any information as to the profits of these particular company stores, the highly profitable character of such a business can be illustrated from the data available for the Union Supply Co., a subsidiary of the Carnegie Steel Co., which operates company stores situated largely in the coke region. These stores are operated under the same general conditions and do much the same business that is done in the company stores connected with blast furnaces and steel works. No investigation has been made of the prices charged by these stores, but the chairman of the United States Steel Corporation, on June 8, 1911, testified before the House committee with regard to these stores as follows:

> Where we have stores, and we have not very many, we have made it certain that the goods were sold to our men at prices less than they could purchase the same things elsewhere.[1]

On April 1, 1902, the Union Supply Co. took over the business of the Union Supply Co. (Ltd.), which had formerly operated the stores. The transaction amounted to an increase of the capital stock of the old company, since the Union Supply Co. issued its own stock to the amount of $500,000 to replace the stock amounting to $75,000 of the Union Supply Co. (Ltd.) and assumed its debts. No additional funds were put into the company at this time.[2]

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[1] Hearings before House Committee on Investigation of United States Steel Corporation, p. 238.

[2] Idem, p. 4163.

The dividends of these two companies from 1898 to 1910 amounted to $4,703,067 on a capitalization which was originally $75,000, but was increased to $500,000 without the addition of new funds.[1] Within 12 years, therefore, these stores have paid the stockholders (in this case the United States Steel Corporation) 62 times as much as the capitalization at the beginning of the period without any new investment except what has been made out of earnings. In 1910 the total assets of the Union Supply Co. amounted to approximately $1,400,000, the properties, inventories, and cash amounting to $1,000,000. All but $75,000 of these assets represent surplus earnings reinvested in the property.

The following table shows for each year from 1898 to 1910, inclusive, the dividends paid by the companies operating these stores. In 1902, the year in which the Union Supply Co. took over the business, it is necessary to show the dividends for the two companies separately, as the nominal capitalization is different.

DIVIDENDS OF UNION SUPPLY CO. (LTD.), 1898 TO APRIL, 1902, AND OF UNION SUPPLY CO., SUCCESSOR, MAY, 1902, TO DECEMBER, 1910.

[From Hearings before House Committee on Investigation of United States Steel Corporation, p. 4164.]

Year.	Capital stock.	Dividends.		Year.	Capital stock.	Dividends.	
		Amount.	Per cent of capital stock.			Amount.	Per cent of capital stock.
1898	$75,000	$350,000	466⅔	1904	$500,000	$405,000	81
1899	75,000	225,000	300	1905	500,000	255,000	51
1900	75,000	150,000	200	1906	500,000	550,000	110
1901	75,000	75,000	100	1907	500,000	500,000	100
1902 (Jan. to Apr.)	75,000	413,067	550¾	1908	500,000	320,000	64
1902 (May to Dec.)	500,000	250,000	50	1909	500,000	440,000	88
1903	500,000	250,000	50	1910	500,000	520,000	104

The Union Supply Co. (Ltd.) during the 52 months for which records are available paid dividends equal to slightly over 1,617 per cent of its capitalization of $75,000, which represents an average of 372 per cent per annum. The Union Supply Co., with a nominal capitalization of $500,000 has paid dividends aggregating 698 per cent, covering 104 months of business, which means an average per annum of 80.5 per cent, or 537 per cent on the original capitalization of $75,000. The dividends in 1910 amounted to $520,000, which equals 37 per cent of the total assets claimed by the company at the end of the year, or 52 per cent on the amount represented by the cost of properties, inventories, and cash.

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[1] Hearings before House Committee on Investigation of United States Steel Corporation, p. 4164.

The balance sheet showing the condition of the company on December 31, 1910, follows:

BALANCE SHEET OF UNION SUPPLY CO., DECEMBER 31, 1910.

[From Hearings before House Committee on Investigation of United States Steel Corporation, p. 4165.]

ASSETS.		LIABILITIES.	
Cost of properties	$274,554.36	Accounts payable, general	$97,453.59
Deferred charges to operation	256.67	Accrued taxes	16,981.84
United States Steel Corporation depreciation fund	38,877.03	Depreciation and extinguishment funds	68,877.03
Inventories	638,407.27	Insurance funds	51,853.00
United States Steel Corporation insurance fund	51,853.00	Appropriated surplus to cover investment in property	48,066.55
United States Steel Corporation clearance fund	321,512.26	Surplus accrued since Apr. 1, 1901	615,641.52
Accounts receivable, general	977.98	Capital stock	500,000.00
Agent's balance	2,400.17		
Cash	90,034.79		
Total	[1] 1,398,873.53	Total	1,398,873.53

[1] Error of $20,000 in typing items.

This statement shows that the company had on that date an accrued surplus of $615,641.52 and that in addition $48,066.55 had been appropriated to cover investments in property. The statement also explains the large profits earned by the company. The accounts receivable amounted to only $977.98, which means that there are practically no losses through bad debts which form such a considerable item in the accounts of most retail merchants. At the same time such a concern is able to purchase at much more favorable terms as regards both prices and credit than the ordinary retail merchant.

This store company, it is true, does a much larger amount of business than any of the company stores which operate at a single plant, and therefore has some advantage in prices and credit. On the other hand the company stores connected with iron and steel plants have their business concentrated at a single point, while the Union Supply Co. has a number of relatively small stores located in different towns, which is a considerable disadvantage, particularly as regards operating expenses.

The probable profits of these company stores are also illustrated by the case of one blast-furnace plant which issued store orders on a noncompany store. The books of the store showed payments to the steel company equal to 10 per cent of all the store orders cashed or accepted in exchange for purchases during the preceding month. In other words, it was profitable for the storekeeper to pay the steel company a commission of 10 per cent on all sales for issuing store orders and thus insuring the store of getting a considerable part of the business of the employees.

At one establishment, employing over 2,500 men, it was ascertained that the store orders on its affiliated store amounted to 22.6 per cent of the total annual pay roll of more than $3,000,000.

A considerable amount, in addition to that represented by store orders, is taken in at these stores from sales to employees who occupy salaried and clerical positions and are as a rule credited without orders. To this class of employees the store order is objectionable and therefore the establishments generally exempt them from the rule requiring orders.

At one establishment the employees objected to the prices at the company store and stated that they had to pay these high prices or go 4 miles to the next nearest store. At another plant the prices charged at a noncompany store were so high that almost every employee signed a petition for the establishment to open a company store, declaring that as matters then stood they could accept the 80 cents on the dollar which this store paid for its store orders and with the cash purchase goods elsewhere at a considerable saving.

CHAPTER XVII.

PENSION FUNDS, PROFIT-SHARING PLANS, AND PLANT AND COMMUNITY SANITATION.

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PENSION FUNDS, PROFIT-SHARING PLANS, AND PLANT AND COMMUNITY SANITATION.

INTRODUCTION.

The purpose of this chapter is to discuss briefly the operations of those companies which have extended their relations with employees beyond the payment of an agreed rate of wages and the provision of a reasonably safe working place. Leaving out of consideration altogether the measures that have been taken for the physical and financial relief of injured employees, the undertakings of such companies have been practically limited to the establishment of pension funds and profit-sharing plans and to the inauguration of definite plans for the proper sanitation of the mills and for a supply of pure water.

Little of what is generally known as "welfare work" is to be found in the steel industry. In a few places, it is true, playgrounds have been established by the steel plants or with their cooperation; a few clubs, open usually only to the officials and clerical force, exist; contributions to "social centers" and various other sociological organizations are sometimes made by steel companies; and in a very few cases schools for the instruction of employees have been established or in part supported. Such cases are, however, sporadic, and, being precisely similar to such undertakings in connection with other industrial establishments, a mention of their existence seems sufficient.

PENSION FUNDS.

PENSION SYSTEM OF THE UNITED STATES STEEL CORPORATION.

The plan, organization, and rules of the United States Steel and Carnegie Pension Fund are set forth in the official announcement issued by the Steel Corporation, as follows:

> The United States Steel and Carnegie Pension Fund was established in the year 1910 by the joint action of the United States Steel Corporation and Andrew Carnegie. Its purpose is the payment to employees of old-age pensions from the income of the fund. For this purpose the United States Steel Corporation provided $8,000,000, which, with the Carnegie Relief Fund of $4,000,000 created by Andrew Carnegie on March 12, 1901, makes up a joint fund of $12,000,000. This pension fund is administered by a board of 12 trustees, through a manager appointed by the board with such powers and duties as may be given him by the board. The pension rules are established by resolution of the board of trustees.

PENSION RULES.

WHO MAY OBTAIN PENSIONS.

1. Employees of the United States Steel Corporation or of any other corporation a majority of whose capital stock is owned or controlled by the United States Steel Corporation, or of the board of trustees of this pension fund, may obtain pensions under the following conditions:

First.—Pensions by compulsory retirement.

2. All men who have been twenty (20) years or longer in the service and have reached the age of seventy (70) years shall be retired and pensioned.

3. All women who have been twenty (20) years or longer in the service and have reached the age of sixty (60) years shall be retired and pensioned.

4. At the request of their employing officers persons employed in executive or administrative positions may be allowed to continue in active service after reaching the ages mentioned above.

Second.—Pensions by retirement at request.

5. Any man who has been twenty (20) years or longer in the service and has reached the age of sixty (60) years may be retired and pensioned either at his own request or at the request of his employing officer.

6. Any woman who has been twenty (20) years or longer in the service and has reached the age of fifty (50) years may be retired and pensioned either at her own request or at the request of her employing officer.

Third.—Pensions for permanent incapacity.

7. Any employee who has been twenty (20) years or longer in the service and has become permanently totally incapacitated through no fault of his or her own as a result of sickness, or injuries received while not on duty, may be pensioned at the discretion of the board of trustees.

AMOUNT OF PENSIONS.

8. The monthly pensions to be paid will be made up on the following basis, subject to the provisions of section 27:

For each year of service one per cent (1%) of the average regular monthly pay received during the last ten years of service.

ILLUSTRATION.—An employee who has been twenty-five (25) years in the service and has received an average regular monthly pay of sixty dollars ($60) a month will receive a pension allowance of twenty-five per cent (25%) of sixty dollars ($60) or fifteen dollars ($15) a month.

9. No pension granted shall be more than one hundred dollars ($100) a month or less than twelve dollars ($12) a month.

HOW TO OBTAIN PENSIONS.

Pensions by compulsory retirement.

10. Employing officers will report to the manager of the fund the name of every man who has been twenty (20) years or longer in the service and has reached the age of seventy (70) years, and of every woman who has been twenty (20) years or longer in the service and has reached the age of sixty (60) years. These reports will be sent to the president of the company concerned for his approval.

Pensions by retirement at request.

11. Any man who has been twenty (20) years or longer in the service and has reached the age of sixty (60) years, and any woman who has been twenty (20) years or longer in the service and has reached the age of fifty (50) years, who wishes to be retired and pensioned, should notify his or her employing officer.

12. Any employing officer who wishes to retire an employee who has reached the age and has had the length of service fixed for retirement by request must notify such employee and report to the manager of the fund the request that such employee be retired and pensioned. These requests whether from an employee or an employing officer will be sent to the president of the company concerned for his approval.

Pensions for permanent incapacity.

13. Any employee who has served twenty (20) years and who is permanently totally incapacitated through no fault of his or her own as a result of sickness, or injuries received while not on duty, may notify his or her employing officer and apply for a pension. Every such application will be sent by the employing officer to the president of the company concerned for his approval. In every such case it must be shown to the satisfaction of the board of trustees by physical examination that the employee applying for a pension is permanently totally incapacitated to earn a livelihood.

GENERAL REGULATIONS.

14. Pensions from the fund will be paid only to those employees who have given their entire time to the service of corporations included under the provisions of the fund.

15. The acceptance of a pension from the fund shall not bar any former employee from engaging in other business so long as such other business is not of the same character as the former employment. No employee receiving a pension may reenter the service.

16. Length of service shall be reckoned from the date since which the employee has been continuously in the service to the date when retired, and a part of a year if less than a half shall not be counted; if more than a half it shall be counted as a full year.

17. Leave of absence, suspension, temporary lay-off on account of reduction in force, or disability shall not be considered as breaks in the continuity of service, and time thus lost shall not be deducted in reckoning the length of service.

18. Dismissal or voluntarily leaving the service followed by reinstatement within two years shall not be considered as breaks in the continuity of service, but the time thus lost shall be deducted in reckoning the length of service.

19. The board of trustees shall fix the date, in each case, upon which the pensions shall begin.

20. Pensions shall be paid monthly at the close of each month, unless revoked by the board, and shall terminate with payment for the month succeeding that in which the death of the employee occurs.

21. Whenever the term "service" and "in the service" are used in these rules they mean employment by the United States Steel Corporation, by one or more corporations a majority of whose stock is owned or controlled by the United States Steel Corporation, by their predecessors, or by the board of trustees of this fund.

22. Pensions may be withheld or terminated in case of misconduct on the part of the beneficiaries or for other cause sufficient in the judgment of the board of trustees to warrant such action.

23. In order that direct personal relations with retired employees may be preserved and that such employees may continue to enjoy the benefits of pensions granted them,

no assignment of pensions will be permitted or recognized under any cicumstances; neither shall pensions be subject to attachment or other legal process for debts of the beneficiaries.

24. This pension plan is a purely voluntary provision for the benefit of employees superannuated or totally incapacitated after long and faithful service, and constitutes no contract and confers no legal rights upon any employee.

25. The manager of the fund shall decide all questions arising out of the administration of the fund and relating to employees, subject to a right of appeal to the board of trustees within thirty (30) days after notice to the persons interested of the manager's decision. The action of the board of trustees or of any committee designated by the board to hear such appeals shall be final and conclusive.

26. Neither the creation of this fund nor any other action at any time taken by any corporation included under the provisions of the fund or by the board of trustees shall give to any employee a right to be retained in the service, and all employees remain subject to discharge to the same extent as if this pension fund had never been created.

27. Whenever it may be found that the basis named for pensions shall create total demands in excess of the annual income increased by any surplus deemed applicable by the board of trustees, a new basis may be adopted reducing the pensions theretofore or thereafter granted, so as to bring the total expenditures within the limitations fixed by the board of trustees. Notice of such new basis shall be given before the beginning of the year in which it may be decided to put the same into effect. These pension rules may be changed by the board of trustees at its discretion.

28. An annual report giving an account of the fund and its administration will be made as soon after the first of each year as practicable, and copies of such report will be posted at all mills, mines, railroads, shops, and other works and published in such newspapers as may be designated by the board of trustees.

By order of the board of trustees, these rules for the administration of this fund shall take effect on January 1, 1911, and shall apply to those who are in the service on and after that date.

In establishing the joint United States Steel and Carnegie Pension Fund there were assumed all the obligations of the Carnegie Pension Fund established by Andrew Carnegie March 12, 1901, for the benefit of the employees of the Carnegie Steel Co., as well as the obligations of the pension fund of the American Steel & Wire Co., which was established on January 1, 1902. The joint fund, therefore, had at the time of its establishment 1,041 pensioners.

The operations of the United States Steel and Carnegie Pension Fund during the year 1911 were as follows:

Total number of pensioners Dec. 31, 1910	1,041
Number of pensions granted during 1911	565
Total number of pensioners Dec. 31, 1911	1,606
Total amount of pensions paid during 1911	$281,457.37
Average age at which pensions were granted	67
Average years of service of pensioners	30
Average monthly pension	$20.75

In addition to the amount expended for pensions alone, other benefits from the fund were granted employees in the aggregate sum of $67,023, making the total cost of pensions and benefits from the fund $348,480.37.

The cost of administration amounted to $11,737.17, making the total disbursements of the fund $360,217.54.

The administration cost amounted to 3.67 per cent of the disbursements.

PENSION SYSTEM OF THE WISCONSIN STEEL CO.

The pension system of the Wisconsin Steel Co., a subsidiary of the International Harvester Co., was established on May 1, 1910. The essential features of the system are described in the official announcement issued by the International Harvester Co., as follows:

> The board of directors, after careful consideration of the subject and an examination of the various pension systems now in operation, have approved the following plan as the best and most liberal for employees who by long and faithful service have earned an honorable retirement.
>
> The directors establish this pension fund as an evidence of their appreciation of the fidelity, efficiency, and loyalty of the employees.
>
> In the administration of this pension system are associated International Harvester Co., International Harvester Co. of America, and subsidiary companies.
>
> ### PENSION BOARD.
>
> 1. ADMINISTRATION.—The administration of the pension fund shall be in charge of a pension board consisting of five members who shall all be officers or employees of this company or of affiliated or subsidiary companies, and shall be appointed annually by the board of directors of this company, to serve for one year and until their successors are appointed and shall qualify.
>
> 2. OFFICERS.—The pension board shall elect a chairman and a secretary from among its members, and the treasurer of this company shall be ex officio treasurer of the fund. The board may make and enforce rules for the efficient administration of the pension fund, subject to the approval of the board of directors. The pension board shall control the payment of pension allowances under the rules hereinafter stated.
>
> 3. QUORUM.—A majority of the pension board shall constitute a quorum for all purposes.
>
> 4. REPRESENTATION.—The members of the board shall be so chosen that the principal departments of the business shall have representation.
>
> ### PENSION FUND.
>
> 5. The treasurer of the company shall be the custodian and treasurer of the fund, and additions shall be made to said fund yearly or from time to time according to the aggregate pension allowances and the amount available in the pension fund for payment of the same. Should the aggregate pension allowances exceed $100,000 in any one year, then unless the board of directors increases the yearly amount usable for pensions, a new rate shall be established proportionately reducing all allowances.
>
> Payments from this fund shall only be made in accordance with and by direction of the pension board.
>
> ### ELIGIBILITY.
>
> 6. The pension board may authorize the payment of a pension to any retired employee on the following basis:
>
> (*a*) All employees of this company and of subsidiary and affiliated companies, engaged in any capacity, are eligible to pensions as hereinafter stated.

(*b*) All male employees who shall have reached the age of 65 years and have been 20 or more years in the service, may at their own request, or at the discretion of the pension board, be retired from active service and become eligible to a pension.

(*c*) All male employees who have been 20 or more years in the service shall be retired at the age of 70 years on the first day of the calendar month following that in which they shall have attained said age, unless at the discretion of the pension board some later date be fixed for such retirement. Persons occupying executive positions are exempt from maximum age limit.

(*d*) All female employees who shall have reached the age of 50 years and have been 20 or more years in the service may, at their own request, or at the discretion of the pension board, be retired from active service and become eligible to a pension.

(*e*) All female employees shall be retired at the age of 60 years, on the first day of the calendar month following that in which they shall have attained said age, unless at the discretion of the pension board a later date be fixed for such retirement. Persons occupying executive positions are exempt from maximum age limit.

DEFINITIONS.

7. The term "service" and "in the service" apply to all employees of the International Harvester Co., or of any affiliated or subsidiary companies which are now or may hereafter be owned or controlled by it, and of the International Harvester Co. of America, who have received a stated and regular compensation from any of said companies. The term of service shall be reckoned from the date of commencing with the original company whose property and business shall have become those of the International Harvester Co., or any subsidiary companies, or of the International Harvester Co. of America.

8. Temporary Absence.—A temporary lay off on account of illness or of reduction of force is not to be considered as a break in the continuity of service, but when such absence exceeds six consecutive months it shall be deducted in computing the length of active service.

9. Leaving Service.—If a person, after leaving the service for more than two years, shall be reemployed, he shall be considered in his relation to the pension system as a new employee.

PENSION ALLOWANCES AND CONDITIONS.

10. Amount.—The sums which the board of pensions may authorize to be paid monthly to employees retired at the age limit shall be as follows: For each year of active service an allowance of 1 per cent of the average annual pay during the 10 years next preceding retirement; but no pension shall exceed $100 per month or be less than $18 per month.

11. Payment.—(*a*) Pension allowances shall be paid on the first of each month from the date of retirement until the death of employee.

(*b*) At the discretion of the pension board these allowances may be continued to widows and orphans of a pensioner for a limited period.

(*c*) Pension allowances shall be nonassignable, and an attempted transfer or pledge of the same shall not be recognized by the pension board and may in its discretion work a forfeiture thereof.

(*d*) Pension allowances may be suspended or terminated by the pension board in cases of gross misconduct, or of any violation of the rules, or at its discretion, may be paid to some member of the family.

(*e*) The acceptance of the pension shall not debar any retired employee from engaging in any other business which in the judgment of the pension board is not prejudicial to the interests of this company or of any affiliated or subsidiary company, but he can not reenter service.

(*f*) No payments for pensions shall be approved by the pension board until payments from any relief fund operated by this company, or any affiliated or subsidiary company, shall cease.

PENSION—HOW COMPUTED.

12. The amount of pension granted on account of advanced age will depend, as before stated, on two conditions: The number of years the person has served the company, and the amount of his average wages per year for the 10 years next preceding retirement. Thus, for illustration, if the average pay per year for the last 10 years of active service equals $600, and if the service has been continuous for 25 years, the pension would be 25 per cent of $600, or $150 per year, or $12.50 per month. Since the minimum pension has been fixed at $18 per month, then to this regular percentage $5.50 would be added, making the minimum sum of $18.

In special cases where the term of service is less than 20 years, the pension and the amount of same, if any, will be determined solely at the discretion of the board of pensions.

Department heads are expected to keep informed of the whereabouts and physical condition of former employees receiving pensions, and are required to advise the secretary of the board of pensions of the death of the pensioner, and of any other circumstances which would affect his monthly payment.

A physical examination by a company surgeon, or in case of female employees, by a surgeon approved by the board of pensions, will be required of employees who wish to be retired on a pension allowance because of incapacity.

HOW TO SECURE A PENSION.

13. An employee wishing to apply for a pension should first take up the subject with the superintendent at the works where he is employed, or the head of the department in which he is serving, or with a member of the pension board. A form will then be furnished, which must be filled out and signed, giving the necessary information concerning the applicant's age, length of service, and wages. This formal application must be signed by the works superintendent, or head of department employing applicant, and then sent to the secretary of the pension board at his office.

NO CONTRACTUAL RIGHTS CONFERRED.

14. Neither the establishment of this system nor the granting of a pension, nor any other action now or hereafter taken by the pension board, or by the officers of this company, shall be held or construed as creating a contract, or giving to any officer, agent or employee a right to be retained in the service, or any right to any pension allowance, and the company expressly reserves, unaffected hereby, its right to discharge without liability, other than for salary or wages due and unpaid, any employee, whenever the interests of the company may in its judgment so require.

PROFIT-SHARING PLANS.

The profit-sharing plans in effect in the iron and steel industry have in part been fostered by the workmen and in part by the manufacturers. The "sliding scale" of wage payment, the oldest form of profit sharing in the industry, has been in operation in the puddling and rolling mills operated by the Amalgamated Association of Iron, Steel, and Tin Workers for more than 30 years. This scale provides for automatic increases of wages during periods of prosperity, and thereby secures indirectly for the workmen all the benefits of profit sharing. The profit-sharing plans introduced by the manufacturers have for their general purpose the stimulation of greater interest on the part of the workmen in the welfare of the companies by which they are employed and the promotion of longer and more continuous periods of service. These plans, therefore, have as their most important feature the provision of a reward to be received at the end of some period of continuous service.

THE SLIDING SCALE.

The "sliding scale" was introduced into the puddling mills in 1865, at the suggestion of Horace Greeley, to provide some means of automatically readjusting wages to conform with the profits of the manufacturers, so that during a period of high prices wages would be relatively high and during a period of depression they would fall to a base rate, which forms a minimum wage for the occupations covered. The immediate purpose of the sliding scale was to prevent the frequent strikes which occurred during the period of rapidly fluctuating prices at the end of the Civil War. It had an immediate good effect and has been retained in the unionized puddling mills without any change in principle. In 1872 the principle of the sliding scale was extended to the guide mills, in 1879 to the bar mills, and in 1880 to the sheet mills.[1] During the period from 1880 to 1892, when the Amalgamated Association was at the height of its power, the sliding-scale principle was extended to cover practically all the varied products of the union mills.

The "sliding scale," as operated in iron and steel works at the present time, has already been described in detail on pages 153 and 154. It remains, however, to point out its significance as a simple method of profit sharing. Its principal advantage to the manufacturer consists in the fact that the sliding scale in large measure prevents frequent wage disputes. A sliding scale adjusted on a reasonable basis should not require any alteration, except after some radical change in methods of production or economic conditions have taken place. The advantages to the workman are that he is assured that during a period of boom prices his wages will be relatively high, and that during a period of depression his wages will be automatically reduced on a basis determined by joint agreement when he himself was in a fair-bargaining position and not arbitrarily by the manufacturer after the depression had set in.

PROFIT-SHARING PLAN OF THE YOUNGSTOWN SHEET & TUBE CO.

The profit-sharing plan of the Youngstown Sheet & Tube Co. has for its immediate purpose the creation of a more stable force through the payment at the end of each year of a special bonus to men who are in the service at that time. As this bonus amounts to 5 per cent of all that a workman has earned in that year during a period of continuous service (on the average about two weeks' wages), it forms a very definite incentive for workmen to remain throughout the year. This bonus extends to all employees of the company, except four of the general officers and the members of a labor organization who are employed in the puddling mills. The trades-unionists are excluded, on the ground that the company accedes to all their demands in signing the union scale of wages.

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[1] Copies of these early agreements are given in the Tenth Census, 1880, Statistics of Wages, p. 198 et seq.

The profit-sharing plan was adopted, upon the recommendation of the president and board of directors, by a meeting of the stockholders on July 27, 1909, and was put into effect during the year ending June 30, 1910. The plan is very simple and consists in the payment at the end of the fiscal year to each employee (except those enumerated later) a certain percentage of the amount earned by him in that year during a period of continuous service. Only men in the employment of the company on June 30 are entitled to participate. Each man's share is a fixed percentage of the amount that he has earned during the year, or, in the case of those who have been reemployed during the year, since the date of recommencing service with the company. The percentage to be paid is fixed arbitrarily, but for 1910 and 1911 it was 5 per cent.

The only classes of employees who do not participate in the benefits of the plan are the general officers of the company (president, vice presidents, secretary, and treasurer) and the members of the Sons of Vulcan, a union of puddlers. The union members are excluded, as explained above, on the ground that the company in signing the union scale acceded to all the demands of the organization.

The operations of the plan for 1910 and 1911 are as follows:

OPERATIONS OF PROFIT-SHARING PLAN OF YOUNGSTOWN SHEET & TUBE CO., 1910 AND 1911.

	1910	1911
Approximate number of employees participating	5,400	5,700
Amount disbursed as employees' share	$149,090.06	$163,210.10
Approximate share per employee	$27.60	$28.60

The company states that the plan has already shown several good results, chiefly in the direction of increased loyalty on the part of the employees and a tendency to more continuous service.

PROFIT-SHARING PLANS OF THE UNITED STATES STEEL CORPORATION.

The United States Steel Corporation has two methods of compensating its employees which may properly be called profit-sharing plans, namely, the "bonus fund" and the "stock-subscription plan."

THE BONUS FUND.

The so-called bonus fund, however, is limited to supervisory and professional employees and does not reach any of the wage earners. It consists of a fund set aside from the earnings of each year to be distributed to such employees as are deemed worthy of a special reward. The distribution is made upon an arbitrary basis, and complete secrecy is maintained both as to the persons rewarded and the amount received by each. In many cases, however, the amount is large, and serves to spur superintendents and other officers to have their departments make the best possible showing both as to output and cost of production. As the workmen share in the activity which produces the bonus fund, but not in the fund itself, it will be readily understood that the entire arrangement constitutes a source of dissatisfaction on the part of at least a majority of them. They say, moreover, that the temptation of a possible large bonus at the end of the year induces some of the superintendents to require unreasonable tasks of their workmen in the endeavor to secure unusually large production and low costs. In some cases the bonus is said to be equal to one-half of a man's annual salary, and it is not unreasonable to suppose that this bonus is in part the source of "that zeal of operating officials for output, exclusive of all other considerations," which was found by the Steel Corporation's committee of stockholders to be the best explanation of the failure to detach from the steel industry the seven-day schedule of work.[1]

The aggregate amount appropriated each year, 1903 to 1911, for this bonus fund was as stated below:

1903	$1,266,950
1904	1,230,000
1905	1,804,000
1906	3,300,000
1907	3,000,000
1908	1,500,000
1909	2,233,000
1910	2,700,000
1911	1,450,000

THE STOCK-SUBSCRIPTION PLAN.

The stock-subscription plan of the United Steel Corporation is only indirectly a profit-sharing plan and affects only those employees whose savings enable them to purchase a share of stock. It is a highly complex plan, but may be briefly described as consisting in the annual sale by the corporation of a large number of shares of its stock at prices slightly below the market quotations and in the creation of a special fund which is allotted annually as a reward to all employees who remain in the employment of the corporation and in possession of their stock at the end of each year, together with a special reward for those who serve the corporation continuously for five years.

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[1] Report of Committee of Stockholders of the United States Steel Corporation, Apr. 15, 1912, p. 4.

The plan was established in 1903 by the creation of a special fund for the purchase of the stock subscribed to by the employees under the announcement of December 31, 1902. This announcement set forth that during January, 1903, the corporation would offer to its employees shares of its preferred stock for subscription at $82.50, the market price at that time being $86.25 to $89.75 per share. The maximum number of shares to which any man was allowed to subscribe was limited in proportion to his salary as follows:

PER CENT OF SALARY ALLOWED TO BE SUBSCRIBED FOR STOCK, UNITED STATES STEEL CORPORATION.

[This table is reproduced from the original announcement.]

Annual salary.	Per cent of annual salary allowed to be subscribed for stock.
$800 or less	20
$800 to $2,500	15
$2,500 to $5,000	12
$5,000 to $10,000	10
$10,000 to $20,000	8
$20,000 and over	5

It was provided that the stock should be paid for only through a series of monthly installments deducted from the salary or wages of the employees in amounts not to exceed 25 per cent of any one month's salary or wages. Three years were allowed for the completion of the series of payments and 5 per cent interest was charged on all deferred payments.

In case a man discontinued payments, either through financial inability, resignation, or discharge from the corporation's service, the money that had been paid in on account of the principal was returned and he was allowed to keep the difference between the 5 per cent interest paid and the 7 per cent dividend accrued on the stock.[1]

As soon as the stock was fully paid for it was issued to the subscriber and became his property to sell or otherwise dispose of.

The special features of the plan were as follows:

As an inducement to subscribers to remain continuously with the corporation, it was provided that in January of each year a special bonus, amounting to $5 per share,[2] should be paid to each subscriber who was still employed and retained possession of his stock. Furthermore, it was provided that $5 per share should be annually paid into a special fund for all shares which should be originally subscribed for, but on which payments were discontinued. At the end of five years (January, 1908) this special fund, together with accrued interest at 5 per cent, was divided pro rata among all original subscribers who had been continuously employed by the corporation during the entire five years and retained their stock. It was provided that in case subscribers were killed or disabled while in the service of the corporation the amount paid in or the stock itself, if fully paid, should be delivered to his estate, together with the bonus of $5 per share for each of the unexpired five years.

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[1] In later years this provision was changed and, instead of allowing the withdrawing subscriber the dividends, 5 per cent interest was allowed on the amounts paid in, no interest being charged on deferred payments. The full text of the 1912 announcement, containing this provision, is given in Appendix N.

[2] When both preferred and common stock was issued, as in 1909, the bonus per share was $5 on preferred stock and $2.50 on common stock.

As a result of this offer of 1903, 47,551 shares of preferred stock were allotted to 26,399 subscribers, or about 16 per cent of all the employees of the corporation. A very large number of the subscribers of 1903 failed to complete their payments, ceased to be employed by the corporation, or sold their stock before the five-year bonus fund was divided. In January, 1908, at the distribution of the first five-year bonus, there were only 5,409, or 20 per cent, of the original subscribers, holding in all 12,339 shares, who had complied with the requirement of continuous employment and retention of their stock. This great decrease was due to a number of causes, the relative importance of which can not be determined:

1. Many of the original subscribers undertook much more than they could fulfill in making their subscriptions.

2. During the long-continued depression of 1904 large numbers of employees were discharged by the corporation and thus lost possession of their stock.[1]

3. In 1904 the wages of all classes of employees were reduced, and as a result many employees were unable with their lowered income to continue their payments.

4. Many subscribers also sold their stock during the high prices of 1907. During later years the proportion of subscribers continuing to hold their stock and continue in the employment of the corporation for the full five years has been much larger, ranging between 40 and 50 per cent of those originally subscribing.

The bonuses paid by the corporation constitute a considerable inducement to subscribers not to leave the employment of the corporation. The subscriber of 1903, for example, who served continuously and held his stock until January, 1908, received per share, purchased at $82.50, the following amounts:

Dividends (5 years, at $7)	$35.00
Annual bonus (5 years, at $5)	25.00
Share in special 5-year fund	62.50
	122.50

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[1] It is provided in the announcements of later years (e. g., 1912, sec. 11) that a temporary suspension of operations shall not be considered as affecting in any way a subscriber's rights if he resumes work with the corporation when requested.

Assuming even the payment of $5 interest per share on deferred payments, the clear gain per share would be $117.50, an average of 28.5 per cent per annum on the original investment of $82.50.

The subscribers of 1904 on the same basis would have received in 1909:

Dividends (5 years, at $7)	$35.00
Annual bonus (5 years, at $5)	25.00
Share in special 5-year fund	19.10
	79.10
Less assumed interest on deferred payments	5.00
	74.10

The stock was sold at $55 in 1904, and the average interest per year received on the investment was therefore 27 per cent. Furthermore, the stock had increased in value to $115 per share, an increase of 109 per cent.

In 1910 the share of the 1905 subscribers in the bonus fund was $16.80 per share, and the net amount received in bonuses and dividends was $71.80,[1] equivalent to an annual interest of 16.4 per cent on the original investment of $87.50 per share. The shares had also increased in value from $87.50 at purchase to $125 in January, 1910.

In 1911 the net amount received in bonuses and dividends was $76.35,[1] equivalent to an annual interest of 15.3 per cent on the original investment of $100 per share.

The shares had also increased in value from $100 at purchase to $120 in January, 1911.

In 1912 the net amount received in bonuses and dividends was $77.55,[1] equivalent to an annual interest of 15.2 per cent on the original investment of $102 per share. The shares had also increased in value from $102 at purchase to $111.50 in January, 1912. The subscription price at which the stock has been offered in each year and the corresponding market price at the same dates are shown in the following table:

SUBSCRIPTION PRICE AND RANGE OF MARKET QUOTATIONS, PER SHARE OF STOCK, BY YEARS, 1903 TO 1912.

Year.	Class of stock.	Subscription price per share.	Range of market quotations per share.
1903	Perferred	$82.50	$86.25 -$89.75
1904	do	55.00	54.625- 60.00
1905	do	87.50	91.125- 95.75
1906	do	100.00	105.00 -113.25
1907	do	102.00	104.00 -107.75
1908	do	87.50	87.50 - 95.375
1909	do	110.00	112.25 -115.00
	Common	50.00	51.125- 55.125
1910	Preferred	124.00	121.25 -125.375
1911	do	114.00	116.25 -120.00
	Common	70.00	71.375- 80.00
1912	Preferred	108.00	110.125-111.50
	Common	65.00	62.875- 69.875

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[1] Assuming an average charge of $5 per share for deferred payments and all other expenses.

The number of employees classified according to their annual salary, from whom subscriptions were received in each year from 1903 to 1912 is shown in the following table:

NUMBER OF EMPLOYEES FROM WHOM SUBSCRIPTIONS WERE RECEIVED IN EACH YEAR, CLASSIFIED ACCORDING TO ANNUAL SALARY.

Year.	Number of subscribers whose annual salaries were—						Total.
	$800 or less.	$800 to $2,500.	$2,500 to $5,000.	$5,000 to $10,000.	$10,000 to $20,000.	$20,000 and over.	
1903	11,373	13,845	942	179	45	15	26,399
1904	4,126	5,094	514	135	31	12	9,912
1905	3,531	4,297	495	132	26	13	8,494
1906	5,070	6,277	641	156	31	17	12,192
1907	5,276	7,915	731	192	32	17	14,163
1908	9,098	14,302	903	203	36	20	24,562
1909	6,950	11,139	783	196	35	20	19,123
1910	5,923	10,344	844	201	32	19	17,363
1911	9,198	15,841	995	223	37	19	26,313
1912	15,349	20,096	1,215	234	34	18	36,946

The number of shares allotted in each year to subscribers, classified according to their annual salaries or wages, is shown in the following table:

NUMBER OF SHARES ALLOTTED TO SUBSCRIBERS IN EACH YEAR, CLASSIFIED ACCORDING TO ANNUAL SALARY.

Year.	Class of stock issued.	Number of shares allotted to subscribers whose annual salaries were—						Total.
		$800 or less.	$800 to $2,500.	$2,500 to $5,000.	$5,000 to $10,000.	$10,000 to $20,000.	$20,000 and over.	
1903	Preferred	12,841	28,203	4,688	1,232	396	188	47,551
1904	do	8,701	15,709	4,045	1,982	735	472	31,644
1905	do	4,512	9,921	2,228	890	372	257	18,180
1906	do	5,610	13,641	2,884	1,170	352	344	24,001
1907	do	6,058	16,051	3,026	1,312	365	338	27,150
1908	do	9,369	17,392	2,296	922	251	220	30,450
1909	do	5,264	11,161	783	474	154	124	17,960
	Common	2,574	7,377	3,444	1,258	358	376	15,387
1910	Preferred	5,923	14,122	2,715	1,196	323	301	24,580
1911	do	5,783	12,012	1,065	316	104	50	19,330
	Common	5,008	17,574	3,826	1,798	459	416	29,081
1912	Preferred	10,079	17,450	2,144	667	166	113	30,619
	Common	7,154	17,805	3,667	1,443	339	327	30,735

In 1908 the extra bonus was distributed to 5,409 employees, holding in all 12,339 shares of stock. The amount of extra bonus per share of stock then held by subscribers was $65.04.

In 1909 the extra five-year bonus was distributed to 4,085 employees holding 16,019 shares, and the amount of such extra bonus was $19.10 per share of stock so held.

In 1910 the extra five-year bonus was distributed to 3,731 employees holding 9,624 shares, the amount per share being $16.80.

In 1911 the extra five-year bonus was distributed to 4,792 employees, holding 11,569 shares, the amount per share being $21.35.

In 1912 the extra five-year bonus was distributed to 5,588 employees, holding 12,910 shares, the amount per share being $22.55.

Leaving out of account the loss or profit involved in the corporation's purchase of the stock prior to its issue, the cost of the plan up to December 31, 1911, was in round numbers $5,322,000, as shown in detail in the following table:

AMOUNT CONTRIBUTED BY CORPORATION FOR SPECIAL COMPENSATION OR BONUS PAID AND PAYABLE TO EMPLOYEES IN CONNECTION WITH THEIR SUBSCRIPTIONS TO STOCK.

Year in which contributed.	Total.	On account of subscriptions for the years named.			
		1903	1904	1905	1906
1903	$240,035.00	$240,035.00			
1904	403,568.50	243,828.50	$159,740.00		
1905	500,204.50	249,634.25	160,875.25	$89,695.00	
1906	628,413.25	256,439.25	162,104.25	90,364.75	$119,505.00
1907	776,359.00	264,026.50	164,539.00	91,028.25	121,465.25
1908	669,532.36		166,344.50	91,400.00	122,024.25
1909	665,726.75			104,157.25	129,561.50
1910	680,703.31				126,619.25
1911	757,936.55				
Total	5,322,479.22	1,253,963.50	813,603.00	466,645.25	619,175.25
Of the above totals there were paid to subscribers at close of the calendar years in which the plan was operative, but not including the extra five-year bonus	3,026,688.42	461,434.94	507,640.10	304,962.05	371,415.00
Balance distributed in the extra five-year fund	1,809,767.50	802,528.56	305,962.90	161,683.20	247,760.25
Balance at Dec. 31, 1911, for distribution in extra five-year fund at end of such periods	486,023.30				

Year in which contributed.	On account of subscriptions for the years named.				
	1907	1908	1909	1910	1911
1903					
1904					
1905					
1906					
1907	$135,300.00				
1908	137,203.61	$152,560.00			
1909	144,172.30	157,575.70	$130,260.00		
1910	141,496.30	156,528.00	130,669.76	$125,390.00	
1911	143,790.79	158,479.89	131,390.11	125,894.76	$198,381.00
Total	701,963.00	625,143.59	392,319.87	251,284.76	198,381.00
Of the above totals there were paid to subscribers at close of the calendar years in which the plan was operative, but not including the extra five-year bonus	410,130.41	377,282.12	269,057.82	181,058.49	153,707.49
Balance distributed in the extra five-year fund	291,832.59				
Balance at Dec. 31, 1911, for distribution in extra five-year fund at end of such periods		247,861.47	123,262.05	70,226.27	44,673.51

IMPROVEMENT OF PLANT SANITATION.

As an organized movement the improvement of the sanitation of steel mills is of very recent development and dates practically from the active work undertaken by the American Iron and Steel Institute in 1911. As a matter of practical achievement, however, great advances in the healthfulness and cleanliness of many of the plants had been made prior to 1911. These improvements were in large part made in connection with the extensive reconstruction of plants which took place during the decade 1901 to 1910.

In many of the older plants, prior to their reconstruction, the buildings were so cramped and had become so dilapidated that the maintenance of even a fair degree of cleanliness and sanitation was impossible. Furthermore, practically all mill buildings constructed prior to 1895 had uneven dirt floors and particularly in the hand rolling mills were made almost constantly damp, if not actually muddy, from the waste water used to flush the rolls. The roofs were low, and were for the most part either without adequate ventilation or were so loosely constructed as to afford inadequate protection against rain and wind. In the original plans of the mill buildings no attention had been given to the possibility of future enlargement, and as a consequence the additions made to the buildings were most frequently roughly constructed, shed-like structures, which at best gave only partial protection to the workmen. Practically no attention was paid to the provision of toilet facilities, or to the disposal of garbage and dirt. The drinking water was good or bad according to the state of the local supply and was furnished usually in large barrels in which cakes of ice were placed in summer. The combustion of fuel in the heating furnaces built before 1900 was often very imperfect and little attention was paid to ventilation or to the disposal of smoke and fumes. The gas producers, most of which constantly emitted clouds of black smoke, were frequently under the same roof as the furnaces and rolling mills. As a consequence many of the mills, particularly the open-hearth and heavy rolling mill buildings, were almost constantly filled with heavy black smoke and gaseous fumes. Mules were frequently used to haul materials and products from one part of the mill to another and their presence did not contribute to the general cleanliness of the mills.

Most of these older mills have either been reconstructed or abandoned for new plants within the past 10 years. In the reconstruction the work has in most cases been thorough, and entirely new buildings, well planned and well constructed, have been substituted for the cramped and dilapidated structures. The new buildings are almost without exception durably constructed of steel, brick, and concrete, with high roofs and sufficient floor space to make cleanliness practicable. Well-drained concrete floors are usually provided wherever water is likely to collect. The best designed plans provide separate buildings for gas producers and special ventilation in the neighborhood of furnaces, which have also been improved to secure more complete combustion of fuel and to prevent the escape of smoke and fumes. The mule has been banished from the mills, and adequate, and in many cases excellent, toilet facilities have been provided.

A large part of the increased cleanliness of the plants is the direct result of the movement for safety. A high degree of cleanliness of mills and yards and perfect orderliness in the disposal of materials and products are recognized by all safety committees to be prime requisites in cutting down the accident rate. Most of the large plants, therefore, maintain a special force of laborers whose sole duties consist in cleaning up the mills and yards. In many cases old or partially disabled employees are utilized for this service.

All of the improvements described above were of the kind whose necessity could be readily appreciated and which could be dealt with in the individual plants. The questions of water supply and of the general sanitation of the communities surrounding the plants required some form of educational campaign in order that their significance should be appreciated. The American Iron and Steel Institute, which includes practically all the steel manufacturers of the United States, was the organization through which such a campaign was undertaken.

COMMUNITY SANITATION.

The general lack of effort for the improvement of the communities in which the employées of the steel industry live may in part be attributed to the fact that practically all the employees are adult males. No women are employed in the mills, and very few children. Since the workmen are so largely grown men, the steel manufacturers have felt no responsibility beyond that of paying the established scale of wages. Furthermore, since the manufacturer or manager is brought into contact with the women and children of the community only indirectly, if at all, it is not surprising that very little notice has been taken of the conditions under which they live.

Another reason which may have a bearing on the general indifference of the managers of steel plants toward the communities in which they are situated is that the labor force is not generally recruited from among the native population but from the more recently arrived immigrants.

Finally, the apparent cause of the failure of most of the plans for the education, recreation, or general improvement of the adult employees is the schedule of working hours. Libraries and night schools are at best unattractive at the end of a 12-hour day, and all forms of amusement, except the most stimulating, are likely to be passed by. Good libraries exist in many of the towns, but in all cases, the steel workers' patronage is extremely limited. In many cases cards are issued in the name of steel workers, but the books are drawn by their wives and children. The long schedule of working hours is said by the workmen also to be the cause of the disuse of several excellent shower-bath systems. At the end of the thirteenth hour away from home a shower, however refreshing, is less alluring than the prospect of a hot meal and a chance to rest.

It must not be understood that the communities in which the steel plants are located are in such good condition that an intelligent interest on the part of the steel company in local affairs is unnecessary. A number of the companies, it is true, are located in large cities, such as Pittsburgh and Chicago, where the combined action of many forces is necessary for any considerable change. In the majority of cases, however, the steel plants are located either in the suburbs of large cities or in towns of less than 50,000 population, where the influence of the company is potent. The general superintendent of a steel plant in a town of about 50,000 people relates how by a half-hour's use of his telephone he prevented the location of a saloon at the entrance to a new plant which was being put into operation. At the same time within a block of one well-kept row of houses owned by his company was a group of privately owned tenements, the surroundings and general condition of which were a constant menace to some 50 of his most skillful employees. A word from this superintendent would have been sufficient to have stirred the town's health officer as well as the owners of the tenements (local business men in part dependent on the steel company) to a condition of activity that would have effectively removed the nuisance within a short time.

So completely are the people, as well as the business activities, of most of the "steel towns" dependent upon the local steel plant that any proposal made with the sanction of the company would be carried out if within the powers of the community. In only a few cases, however, have the steel companies used their power and influence to work through the medium of the local authorities for the improvement of their communities. The most notable case is one in which a large steel company, after the surrounding community had grown so corrupt and lawless that ordinary travel after dark was unsafe, policed the town with its own men and forced a complete overturning of the local government. This is an extreme instance, but it illustrates the potency of the companies' influence over their communities.

APPENDIXES.

APPENDIX A.—DISTRIBUTION OF IRON AND STEEL PRODUCTION, BY STATES.

Iron and steel works are to be found in almost every section of the country, but the greater part of the iron and steel is produced in a small number of States. The wide distribution of the industry throughout the United States as well as the degree of concentration is shown in a consideration of the annual output of the chief products of the industry by States. The tables which follow show by States the production in 1910 of pig iron, Bessemer and open-hearth steel, and finished rolled products. These figures are compiled from the Annual Statistical Report of the American Iron and Steel Association for 1910. In these reports, in order to avoid revealing the operations of individual plants, two or more States are sometimes combined.

In 1910 pig iron was produced in 22 States, representing nearly every section of the country. The following table shows the tonnage produced in the principal States and in groups of States where the product could not be shown separately. This includes all kinds of pig iron, without distinction as to grade or method of production.

TOTAL PRODUCTION OF PIG IRON IN 1910.

[From Annual Statistical Report of the American Iron and Steel Association for 1910, p. 95.]

States.	Production.	
	Gross tons (2,240 pounds).	Per cent.
Massachusetts and Connecticut	16,582	0.1
New York	1,938,407	7.1
New Jersey	264,781	1.0
Pennsylvania	11,272,323	41.3
Maryland	326,214	1.2
Virginia	444,976	1.6
Georgia	14,725	.1
Alabama	1,939,147	7.1
West Virginia	174,661	.6
Kentucky	100,509	.4
Tennessee	397,569	1.5
Ohio	5,752,112	21.1
Illinois	2,675,646	9.8
Indiana and Michigan	1,250,103	4.6
Wisconsin and Minnesota	307,200	1.1
Missouri, Colorado, Washington, and California	428,612	1.6
Total	27,303,567	100.0

Five States far outranked all others in the amount of their output, the five together producing 86 per cent of the total tonnage of the country. In the order of their importance they were Pennsylvania, Ohio, Illinois, Alabama, and New York. Since the erection of the new works at Gary, Indiana has come into prominence as a producer of pig iron, and within the next few years it is probable that it will surpass New York as a producing State.

Pennsylvania and Ohio, producing respectively 41 and 21 per cent of the total tonnage of the country, occupy such a predominating position that further consideration of the distribution of the plants within those States is of interest. The production of pig iron in Pennsylvania is given in the table following.

PRODUCTION OF PIG IRON IN PENNSYLVANIA IN 1910, BY DISTRICTS.

[From Annual Statistical Report of the American Iron and Steel Association for 1910, p. 54.]

Districts.	Production.	
	Gross tons (2,240 pounds).	Per cent.
Lehigh Valley	759,250	6.6
Schuylkill Valley	803,362	7.1
Lower Susquehanna Valley	643,270	5.7
Juniata Valley	191,554	1.7
Allegheny County	5,330,982	47.3
Shenango Valley	1,924,508	17.1
Other western Pennsylvania	1,619,397	14.4
Total	11,272,323	100.0

From the above table it will be seen that, while Allegheny County occupies a position of preeminence, the production of pig iron is well distributed throughout the State, east and west. The great producing centers of the State are located very nearly on a line drawn through the center of the State from east to west. The northern part of the State as well as the extreme southern part, both east and west, produce very little pig iron. The greater part of the tonnage is produced in the western part of the State, and particularly in Allegheny County. Within the past few years, owing largely to the development of the Cuban ore mines, there has been a more rapid growth of the industry in the eastern than in the western division of the State. This is of considerable significance from a labor standpoint, as the plants in the eastern part of the State have paid much lower wages than those in the western part. If these districts should continue to develop rapidly, however, and create a considerable demand for labor, it is probable that the rates of wages will within a few years be much more nearly equalized.

In Ohio the production of pig iron is not so widely distributed as in Pennsylvania, the western and central sections of the State producing very little.

PRODUCTION OF PIG IRON IN OHIO IN 1910, BY DISTRICTS.

[From Annual Statistical Report of the American Iron and Steel Association for 1910, p. 55.]

Districts.	Production.	
	Gross tons (2,240 pounds).	Per cent.
Mahoning Valley	2,534,969	44.1
Hocking Valley and Lake counties	1,474,465	25.6
Hanging Rock	456,903	7.9
Miscellaneous	1,285,775	22.4
Total	5,752,112	100.0

The Mahoning Valley, embracing the general district around Youngstown, is the seat of the greatest production. Furthermore, the greatest increase in recent years has been in this section. The Hanging Rock district, which had a production in 1910 of 456,903 tons, differs in all its industrial characteristics from the remainder of Ohio, and in every particular resembles the Southern States much more closely. Not only is its production almost entirely pig iron, but, like the South, its workmen are nearly all Negroes.

The production of open-hearth steel is as widely distributed as the production of pig iron. In 1910, 23 States and the District of Columbia produced some steel, although in many the tonnage was small. Not all of this steel, however, was made in steel works, a part of it being produced in commercial steel foundries. For this reason the number of States producing open-hearth steel in connection with steel works would include not more than 18 States—probably one or two less.

PRODUCTION OF OPEN-HEARTH STEEL INGOTS AND CASTINGS IN 1910, BY STATES.

[From Annual Statistical Report of the American Iron and Steel Association for 1910, p. 64.]

States.	Production.	
	Gross tons (2,240 pounds)	Per cent.
New England	223,158	1.4
New York and New Jersey	713,245	4.3
Pennsylvania	10,153,816	61.5
Delaware, Maryland, and District of Columbia	158,827	1.0
West Virginia, Kentucky, Georgia, and Alabama	738,392	4.5
Ohio	1,733,409	10.5
Indiana	1,307,129	7.9
Illinois	995,011	6.0
Michigan and Wisconsin	38,638	.2
Other States	442,884	2.7
Total	16,504,509	100.0

The position of Pennsylvania, with 61 per cent of the entire tonnage, entirely overshadows all the other States. Only two other States, Ohio and Indiana, produced one-tenth as much as Pennsylvania, although Illinois was not far behind this mark. Pennsylvania has, however, been gradually losing her preeminence in this branch of the industry, for in 1905 and 1906, 71 per cent of the entire product of the country belonged to this one State alone, as against 61 per cent in 1910. In 1910 there were 147 plants engaged in the production of open-hearth ingots and castings.

The production of Bessemer steel is almost as widely distributed geographically as that of open-hearth steel, but the number of plants engaged in its production is less than half as great. There were 22 States and the District of Columbia concerned in the production of Bessemer steel in 1910, but in many of these the output was insignificant. There were only 71 plants producing steel by any of the modifications of the Bessemer process, and only 25 of these were of the standard Bessemer type and size, the remainder being small converters used in steel foundries.

PRODUCTION OF BESSEMER STEEL INGOTS AND CASTINGS IN THE PRINCIPAL STATES, 1910.

[From the Annual Statistical Report of the American Iron and Steel Association for 1910, p. 61.]

States.	Production.	
	Gross tons (2,240 pounds)	Per cent.
Ohio	3,314,053	35.2
Pennsylvania	2,975,750	31.6
Illinois	1,693,053	18.0
Other States	1,429,916	15.2
Total	9,412,772	100.0

The most notable fact shown in this table is the leading rank of Ohio in this branch of the industry, with 35 per cent of total tonnage of the country. This position has been attained only in the last three years, for previous to 1909 Pennsylvania had been the leading State. Furthermore, the position has been attained through the abandonment of Bessemer plants in Pennsylvania and not through the construction of new plants in Ohio. The production in Ohio in 1910 was less by 450,000 tons than in 1906, the year of maximum production of Bessemer steel. The tonnage of Illinois has hardly varied in the last five years.

The widest distribution in any branch of the industry, both geographically and in respect of the total number of works, was in the production of finished rolled products. In 1910 there were rolling mills in 27 States, the total number of separate works being 396. This wide distribution is due chiefly to three causes: First, the amount of capital required to establish a rolling mill is small in comparison to the amount needed in other branches of the industry; second, the finished products are frequently wanted for immediate delivery, so that the distance and time required for shipment to the market is an important factor; third, the freight classification on finished products is much higher than on the more bulky raw and semifinished materials, so that proximity to the market is of importance.

In the following table is shown the production of finished rolled iron and steel in the principal States and groups of States in 1910. Under the phrase rolled iron and steel is included all iron and steel rolled into finished forms. Forged armor plate, hammered axles, and other forgings are not included, nor such intermediate rolled forms as muck bars, slabs, blooms, billets, tin plate, and sheet bars, etc. Rolled forging blooms and rolled forging billets are, however, included.

PRODUCTION OF ALL KINDS OF FINISHED ROLLED IRON AND STEEL IN 1910, BY STATES.

[From Annual Statistical Report of the American Iron and Steel Association, 1910, p. 87.]

States.	Production.	
	Gross tons (2,240 pounds).	Per cent.
Maine and Massachusetts	171,782	0.8
Rhode Island and Connecticut	121,065	.6
New York	1,013,768	4.7
New Jersey	165,057	.8
Pennsylvania	10,774,531	49.8
Delaware	13,063	.1
Maryland	307,837	1.4
Virginia	23,743	.1
West Virginia	405,925	1.9
Kentucky, Tennessee, Georgia, and Texas	235,150	1.1
Alabama	426,471	2.0
Ohio	3,228,223	14.9
Indiana	1,310,645	6.1
Illinois	2,547,662	11.8
Michigan and Wisconsin	305,175	1.4
Missouri	84,320	.4
Colorado, Wyoming, and Washington	442,784	2.0
Oregon and California	44,078	.2
Total	21,621,279	100.0

The predominant State in the production of rolled iron and steel was Pennsylvania, with 49.8 per cent of the total tonnage of the country. Next in order were Ohio with 14.9, Illinois with 11.8, Indiana with 6.1 per cent, and New York with 4.7 per cent. No other State produced as much as 2 per cent of the total.

APPENDIX B.—DISTRIBUTION OF STEEL PLANTS, BY SIZE OF COMMUNITIES IN WHICH LOCATED.

The following table shows for each of the districts and for the country as a whole the number of employees and also the per cent of employees in each district and in the country as a whole in plants located in towns and cities of various sizes. The plants are separately grouped according to their ownership by the Steel Corporation, by the large independent companies, or by the small companies.

DISTRIBUTION OF EMPLOYEES OF THE DIFFERENT GROUPS OF COMPANIES ACCORDING TO CLASSIFIED POPULATION OF TOWNS AND CITIES IN WHICH PLANTS ARE LOCATED, BY DISTRICTS.

District and group ownership.	Total number of employees.	Per cent of employees in plants located in cities of population—				
		Under 10,000.	10,000 and under 30,000.	30,000 and under 100,000.	100,000 and over.	
					City.	Suburb.
New England district:						
Steel Corporation	977	....	....	....	100.0	....
Large independent companies	573	....	....	....	100.0	....
Small companies	4,843	37.0	6.6	40.9	15.5	....
Total	6,393	28.0	5.0	31.0	36.0	....
Eastern district:						
Steel Corporation	1,747	....	....	17.5	....	82.5
Large independent companies	12,258	11.6	46.4	13.4	2.7	25.9
Small companies	25,747	42.1	17.7	21.9	12.9	5.3
Total	39,752	30.9	25.8	19.2	9.2	15.0
Pittsburgh district.						
Steel Corporation	45,054	17.3	17.8	23.0	13.8	28.1
Large independent companies	34,254	1.5	9.2	54.9	34.4	....
Small companies	24,190	21.3	26.9	6.1	25.2	20.5
Total	103,498	13.0	17.1	29.6	23.3	17.1
Great Lakes and Middle West district:						
Steel Corporation	25,416	....	42.1	10.4	47.5	....
Large independent companies	16,119	21.5	10.8	34.3	....	33.4
Small companies	27,574	22.1	10.9	6.8	51.3	8.9
Total	69,109	13.9	22.3	14.5	37.9	11.3
Southern district:						
Steel Corporation	2,822	73.0	21.3	....	5.7	....
Large independent companies	....	....	....	....	....	....
Small companies	9,172	59.0	10.5	11.3	16.1	3.1
Total	11,994	62.3	13.0	8.7	13.6	2.3
Pacific coast district:						
Steel Corporation	....	....	....	....	....	....
Large independent companies	....	....	....	....	....	....
Small companies	511	22.9	....	....	77.1	....
Total	511	22.9	....	....	77.1	....
All districts:						
Steel Corporation	76,016	13.0	25.4	17.5	25.5	18.6
Large independent companies	63,204	8.5	16.7	41.1	20.1	13.5
Small companies	92,037	32.0	16.7	13.1	28.4	9.8
Total	231,257	19.3	19.6	22.2	25.2	13.7

APPENDIX C.—CHARACTERISTICS OF THE LABOR FORCE OF A REPRESENTATIVE STEEL PLANT.

The following table shows in a complete manner the principal characteristics of the labor force of one of the large representative steel plants located in the Pittsburgh district.

The table shows for the plant as a whole and separately for each department the age and the years of service of the workmen, classified according to skill, nativity, and conjugal condition. The supervisory and clerical employees are not included, these employees being shown separately in the table on pages 494 to 496. For discussion of these tables see Chapter III, page 79.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF WORKMEN[1] OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO SKILL, NATIVITY, AND CONJUGAL CONDITION.

ALL DEPARTMENTS.

(M.—Married; S.—Single; W.—Widowed.)

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees.									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																														
Under 16 years	......	5	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	4	....	....	....	....	......	....	....
16 and under 18 years	......	145	....	....	1	....	....	....	....	....	....	....	....	9	....	....	....	....	....	2	....	....	114	....	....	5	....	......	14	....
18 and under 20 years	3	289	....	....	8	....	....	....	....	....	1	....	....	67	....	....	6	....	1	8	....	....	124	....	....	11	....	2	64	....
20 and under 25 years	348	835	4	44	122	....	8	12	....	9	9	....	51	190	1	6	24	....	107	133	2	12	62	....	4	15	....	107	268	1
25 and under 30 years	890	367	6	153	81	....	30	30	....	53	6	....	66	39	2	24	24	....	257	55	1	18	15	....	4	15	1	285	102	2
30 and under 35 years	859	137	12	182	28	3	67	12	1	73	6	....	43	8	3	27	17	....	199	17	1	8	9	....	14	5	....	246	35	4
35 and under 40 years	853	103	14	180	27	2	84	10	2	50	6	1	46	10	1	31	5	1	184	9	1	9	8	1	11	11	1	258	17	4
40 and under 45 years	544	45	20	113	14	7	76	9	2	36	1	1	17	4	....	20	4	2	91	3	1	8	1	....	21	4	4	162	5	3
45 and under 50 years	367	38	19	63	9	5	63	6	3	24	....	....	20	....	....	21	1	....	43	1	2	7	5	1	18	9	6	108	7	2
50 and under 60 years	312	14	34	72	2	8	74	....	9	3	....	....	19	3	2	28	1	3	15	2	1	12	1	2	35	3	3	54	2	6
60 years and over	80	2	20	13	.....	3	12	....	7	1	....	....	7	.....	....	12	....	....	.....	.....	....	8	.....	3	19	2	6	8	.....	1
Total	[3] 4,260	[3] 1,983	129	820	292	28	414	79	24	249	29	2	269	[4] 333	9	169	82	6	[5] 898	[5] 231	9	82	343	7	[5] 127	80	21	[4] 1,232	514	23

YEARS OF SERVICE.																														
Under 2 years	257	427	2	23	12	....	11	2	....	....	....	....	19	61	1	10	18	....	32	24	....	13	113	....	8	25	....	141	172	1
2 and under 3 years	253	295	1	17	13	....	8	6	....	3	2	....	11	34	....	6	11	....	49	38	....	4	58	....	3	5	....	152	128	1
3 and under 4 years	166	182	2	17	9	....	5	2	....	5	5	....	12	34	....	5	3	1	35	27	....	5	53	1	4	6	....	78	43	....
4 and under 5 years	225	205	3	27	19	1	4	9	....	2	....	....	24	43	....	10	7	....	63	31	....	9	32	....	5	8	....	81	56	2
5 and under 10 years	1,092	558	18	140	108	2	43	23	....	63	15	1	68	127	3	22	23	1	351	87	3	14	70	....	15	12	2	376	93	6
10 and under 15 years	1,024	190	18	261	86	2	68	19	1	101	5	....	71	24	1	27	12	2	243	18	4	8	9	....	11	4	2	234	13	6
15 and under 20 years	486	56	25	133	21	6	80	6	3	42	1	....	28	6	4	20	4	....	76	4	1	9	3	2	12	3	5	86	8	4
20 and under 25 years	429	49	22	112	20	6	87	9	6	27	1	1	22	3	....	32	2	2	43	....	1	7	4	2	29	9	2	70	1	2
25 and under 30 years	174	15	17	47	2	4	51	1	6	4	....	....	9	1	....	15	2	....	6	2	....	4	....	....	24	7	6	14	....	1
30 and under 35 years	102	4	9	31	1	4	37	2	2	1	....	....	3	....	....	15	....	....	....	....	....	4	....	1	11	1	2	....	....	....
35 years and over	49	1	12	11	....	3	20	....	6	1	....	....	2	....	....	6	....	....	....	....	....	4	1	1	5	....	2	....	....	....
Total	[6]4,260	[7]1,983	129	[7]820	[7]292	28	414	79	24	249	29	2	269	333	9	[7]769	82	6	898	231	9	[7]82	343	7	127	80	21	1,232	514	23

BLAST FURNACES.

AGE.																														
Under 16 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....
18 and under 20 years	1	28	....	....	....	....	....	....	....	....	....	....	....	10	....	....	1	....	....	2	....	....	7	....	....	1	....	1	7	....
20 and under 25 years	44	117	2	1	3	....	....	....	....	....	....	....	4	25	....	....	5	....	19	16	1	....	2	....	....	6	....	20	60	1
25 and under 30 years	106	49	1	6	1	....	....	2	....	....	....	....	8	8	....	1	4	....	49	8	....	1	4	....	2	7	....	39	15	1
30 and under 35 years	105	13	2	5	2	....	1	....	....	....	....	....	4	....	....	6	1	....	39	2	1	1	2	....	1	....	....	48	6	1
35 and under 40 years	102	10	1	7	1	....	4	1	....	....	....	....	6	1	....	2	1	....	32	....	1	....	1	....	1	4	....	50	1	....
40 and under 45 years	50	4	2	4	1	....	4	....	....	1	....	....	2	1	....	4	....	1	9	1	....	1	....	....	4	1	1	21	....	....
45 and under 50 years	30	2	1	....	1	....	3	....	....	....	....	....	....	....	....	2	....	....	4	....	....	1	....	....	1	....	1	19	1	....
50 and under 60 years	24	....	1	2	....	....	1	....	....	....	....	....	2	....	....	4	....	....	2	....	....	3	....	....	4	....	1	6	....	....
60 years and over	2	....	1	....	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....
Total	464	224	11	25	9	1	13	3	....	1	....	....	27	45	....	19	12	1	154	29	3	7	17	....	14	19	3	204	90	
YEARS OF SERVICE.																														
Under 2 years	34	71	....	....	....	....	....	....	....	....	....	....	3	18	....	2	4	....	2	4	....	2	7	....	2	10	....	23	28	....
2 and under 3 years	25	34	1	....	....	....	....	....	....	....	....	....	....	4	....	....	2	....	4	5	....	1	....	....	....	2	....	20	21	1
3 and under 4 years	26	18	1	2	....	....	....	....	....	....	....	....	4	3	....	....	....	1	6	1	....	1	3	....	....	2	....	13	9	....
4 and under 5 years	36	30	....	....	2	....	....	1	....	....	....	....	3	8	....	2	2	....	11	4	....	....	1	....	2	1	....	18	11	....
5 and under 10 years	150	49	2	7	1	....	3	....	....	....	....	....	6	9	....	1	2	....	65	13	1	1	4	....	1	1	....	66	19	1
10 and under 15 years	107	10	3	9	3	....	....	1	....	....	....	....	5	1	....	3	1	....	47	2	1	....	....	....	....	....	1	43	2	1

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[1] Superintendents, foremen, clerical employees, janitors, and police are not included in this table, but are shown separately in the tables on pp. 494 to 496.

[2] Including 4, age not reported.

[3] Including 3, age not reported.

[4] Including 2, age not reported.

[5] Including 1, age not reported.

[6] Including 3, years of service in iron and steel industry not reported.

[7] Including 1, years of service in iron and steel industry not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF WORKMEN OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO SKILL, NATIVITY, AND CONJUGAL CONDITION—Continued.

BLAST FURNACES—Concluded.

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees.									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
YEARS OF SERVICE—concluded.																														
15 and under 20 years.	46	4	....	4	1	....	7	....	....	....	....	....	1	1	....	4	....	....	14	....	....	....	1	....	2	1	....	14	....	....
20 and under 25 years.	24	7	1	3	2	....	2	1	....	1	....	....	2	1	....	1	1	....	5	....	1	1	1	....	3	1	....	6	....	....
25 and under 30 years.	7	1	2	....	....	....	1	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	3	1	2	1	....	....
30 and under 35 years.	6	....	1	....	....	1	....	....	....	....	....	....	1	....	....	4	....	....	....	....	....	....	....	....	1	....	....	....	....	....
35 years and over......	3	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....
Total...........	464	224	11	25	9	1	13	3	....	1	....	....	27	45	....	19	12	1	154	29	3	7	17	....	14	19	3	204	90	8

OPEN-HEARTH DEPARTMENT.

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees.									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																														
Under 16 years.........	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years..	....	53	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	44	....	....	1	....	....	8	....
18 and under 20 years..	....	69	....	....	....	....	....	....	....	....	....	....	....	17	....	....	1	....	....	2	....	....	28	....	....	2	....	....	19	....
20 and under 25 years..	85	123	....	11	24	....	....	1	....	5	1	....	7	19	....	1	5	....	30	28	....	1	8	....	....	....	....	30	37	....
25 and under 30 years..	162	64	1	33	18	....	4	5	....	16	3	....	7	7	....	1	2	....	50	16	1	1	1	....	....	....	....	50	12	....
30 and under 35 years..	173	22	2	35	7	....	15	1	1	24	3	....	6	1	1	....	2	....	59	5	....	....	....	....	1	....	....	33	3	....
35 and under 40 years..	158	20	1	37	9	....	17	2	1	20	2	....	7	....	....	1	....	....	46	4	....	1	....	....	....	....	....	29	3	....
40 and under 45 years..	103	5	6	27	1	3	21	2	1	9	....	....	1	....	....	1	1	....	25	....	1	....	....	....	2	....	....	17	1	1
45 and under 50 years..	64	4	3	14	2	2	16	1	1	6	....	....	....	....	....	2	....	....	7	....	....	....	1	....	3	....	....	16	....	....
50 and under 60 years..	36	2	2	8	....	1	8	....	1	2	....	....	1	1	....	2	....	....	2	....	....	2	....	....	4	1	....	7	....	....
60 years and over......	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....
Total...........	782	[1] 363	16	165	61	6	81	12	5	82	9	....	29	[1] 46	1	8	11	....	219	55	2	6	82	....	10	4	1	182	83	1

YEARS OF SERVICE.																														
Under 2 years	46	72	....	1	1	....	1	....	....	....	....	....	1	5	....	....	4	....	12	3	....	....	25	....	....	2	....	31	32	....
2 and under 3 years	63	66	....	2	2	....	....	....	....	....	....	....	1	2	....	....	....	....	25	9	....	....	20	....	....	1	....	435	32	....
3 and under 4 years	36	34	....	3	2	....	1	....	....	3	2	....	....	4	....	1	....	....	10	5	....	1	14	....	....	....	....	17	7	....
4 and under 5 years	45	32	....	3	3	....	1	1	....	1	....	....	3	5	....	2	1	....	22	10	....	....	8	....	....	....	....	13	4	....
5 and under 10 years	188	106	1	25	23	....	5	6	....	22	6	....	9	22	....	....	3	....	78	26	1	1	14	....	....	....	....	48	6	....
10 and under 18 years	213	35	2	68	18	....	18	4	1	32	1	....	9	7	....	1	2	....	58	1	1	2	1	....	2	....	....	23	1	....
15 and under 20 years	85	13	4	28	10	1	21	1	1	14	....	....	4	....	1	....	....	....	8	1	....	1	....	....	....	....	....	9	1	1
20 and under 25 years	72	4	4	20	2	2	24	....	2	8	....	....	2	....	....	3	1	....	5	....	....	1	....	....	3	1	....	6	....	....
25 and under 30 years	25	1	3	10	....	2	7	....	1	2	....	....	....	1	....	1	....	....	1	....	....	....	....	....	4	....	....	....	....	....
30 and under 35 years	7	....	....	4	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....
35 years and over	2	....	2	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....
Total	782	363	16	165	61	6	81	12	5	82	9	....	29	46	1	8	11	....	219	55	2	6	82	....	10	4	1	182	83	1

BLOOMING MILLS.

AGE.																														
Under 16 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years	....	17	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	2	....	....	12	....	....	....	....	....	1	....
18 and under 20 years	....	18	....	....	1	....	....	....	....	....	....	....	....	5	....	....	....	....	....	....	....	....	7	....	....	1	....	....	4	....
20 and under 25 years	30	52	....	6	6	....	....	....	....	1	2	....	5	8	....	....	2	....	6	4	....	....	5	....	....	1	....	12	24	....
25 and under 30 years	58	22	....	17	6	....	3	3	....	3	....	....	4	1	....	2	1	....	8	1	....	1	1	....	....	....	....	20	9	....
30 and under 35 years	52	5	1	10	1	....	5	1	....	3	....	....	1	1	....	1	....	....	12	....	....	....	....	....	....	....	....	20	2	1
35 and under 40 years	65	2	....	16	....	....	10	....	....	2	1	....	1	....	....	4	....	....	11	....	....	2	1	....	1	....	....	18	....	....
40 and under 45 years	52	6	....	12	2	....	7	1	....	3	....	....	3	....	....	....	....	....	6	2	....	....	....	....	....	....	....	21	1	....
45 and under 50 years	39	2	1	11	1	....	9	....	....	6	....	....	1	....	....	1	....	....	2	....	....	1	....	....	....	1	....	8	....	1
50 and under 60 years	40	1	2	12	....	....	11	....	2	....	....	....	4	....	....	1	....	....	2	1	....	....	....	....	4	....	....	6	....	....
60 years and over	9	....	3	4	....	....	3	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	1	....	....
Total	345	125	7	88	17	....	48	5	4	18	3	....	19	17	....	9	3	....	47	10	....	4	26	....	6	3	1	106	41	2
YEARS OF SERVICE.																														
Under 2 years	12	27	....	....	1	....	....	....	....	....	....	....	....	4	....	2	....	....	....	....	....	....	8	....	....	1	....	10	13	....
2 and under 3 years	18	17	....	2	1	....	2	....	....	....	....	....	....	....	....	....	....	....	3	2	....	....	5	....	....	....	....	11	9	....
3 and under 4 years	7	10	....	....	....	....	1	1	....	....	....	....	1	1	....	....	....	....	....	1	....	....	5	....	....	1	....	5	1	....
4 and under 5 years	20	14	....	1	....	....	....	....	....	1	....	....	2	2	....	1	....	....	6	1	....	....	3	....	....	....	....	9	8	....
5 and under 10 years	74	38	....	12	8	....	3	1	....	4	2	....	7	10	....	2	2	....	15	3	....	1	3	....	....	....	....	30	9	....
10 and under 15 years	77	13	3	20	6	....	8	2	....	3	....	....	2	....	....	1	1	....	18	2	....	....	1	....	1	....	1	24	1	2
15 and under 20 years	40	1	....	18	....	....	4	....	....	4	1	....	4	....	....	....	....	....	2	....	....	....	....	....	1	....	....	7	....	....
20 and under 25 years	45	2	2	15	1	....	12	....	2	5	....	....	1	....	....	1	....	....	1	....	....	2	1	....	1	....	....	7	....	....
25 and under 30 years	26	2	1	8	....	....	9	....	1	1	....	....	2	....	....	....	....	....	2	1	....	....	....	....	1	1	....	3	....	....
30 and under 35 years	18	1	....	10	....	....	6	1	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....
35 years and over	8	....	1	2	....	....	3	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	2	....	....	....	....	....
Total	345	125	7	88	17	....	48	5	4	18	3	....	19	17	....	9	3	....	47	10	....	4	26	....	6	3	1	106	41	2

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[1] Including 1, age not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF WORKMEN OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO SKILL, NATIVITY, AND CONJUGAL CONDITION—Continued.

STRUCTURAL MILLS.

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees.									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																														
Under 16 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	....	....	....	....	....
18 and under 20 years	....	14	....	....	1	....	....	....	....	....	....	....	....	4	....	....	1	....	....	....	....	....	6	....	....	1	....	....	1	....
20 and under 25 years	5	30	....	....	7	....	2	1	....	....	....	....	2	4	....	....	....	....	....	1	....	1	2	....	....	1	....	....	14	....
25 and under 30 years	34	19	....	6	2	....	4	....	....	4	....	....	1	2	....	....	1	....	8	3	....	1	....	....	....	....	....	10	11	....
30 and under 35 years	38	8	....	10	....	....	3	....	....	6	1	....	2	....	....	2	1	....	....	1	....	....	....	....	4	....	....	11	5	....
35 and under 40 years	36	8	2	8	1	....	4	1	1	5	2	....	1	....	....	1	....	....	4	....	....	....	1	....	....	2	....	13	1	1
40 and under 45 years	35	3	....	8	....	....	8	....	....	3	1	....	1	....	....	....	2	....	5	....	....	1	....	....	3	....	....	6	....	....
45 and under 50 years	17	5	....	4	1	....	3	....	....	2	....	....	1	....	....	1	....	....	1	....	....	....	....	....	....	2	....	5	2	....
50 and under 60 years	16	....	3	4	....	1	9	....	2	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	2	....	....
60 years and over	2	....	2	1	....	1	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	183	93	7	41	12	2	34	2	4	20	4	....	8	10	....	5	5	....	18	5	....	3	15	....	7	6	....	47	34	1
YEARS OF SERVICE.																														
Under 2 years	11	20	....	....	....	....	1	....	....	....	....	....	....	1	....	....	1	....	....	....	....	2	6	....	3	1	....	5	11	....
2 and under 3 years	10	9	....	2	1	....	....	....	....	....	....	....	....	3	....	1	....	....	....	....	....	....	1	....	....	....	....	7	4	....
3 and under 4 years	5	4	....	1	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	3	....	1	....	....	1	1	....
4 and under 5 years	6	13	....	....	2	....	....	....	....	....	....	....	2	3	....	....	....	....	....	....	....	....	1	....	....	1	....	4	6	....
5 and under 10 years	35	25	....	6	5	....	1	1	....	7	....	....	1	3	....	2	2	....	6	2	....	....	3	....	....	....	....	12	9	....
10 and under 15 years	29	11	1	6	2	....	4	1	....	5	3	....	2	....	....	....	1	....	3	3	....	1	....	....	....	....	....	8	1	1
15 and under 20 years	38	4	1	7	2	1	8	....	....	7	....	....	1	....	....	....	....	....	8	....	....	....	....	....	1	....	....	6	2	....
20 and under 25 years	25	4	2	9	....	....	7	....	2	1	1	....	1	....	....	....	....	....	1	....	....	....	1	....	2	2	....	4	....	....
25 and under 30 years	9	2	....	5	....	....	3	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....
30 and under 35 years	9	1	1	3	....	....	6	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....
35 years and over	6	....	2	2	....	1	3	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	183	93	7	41	12	2	34	2	4	20	4	....	8	10	....	5	5	....	18	5	....	3	15	....	7	6	....	47	34	1

PLATE MILLS.

AGE.																														
Under 16 years		1																					1							
16 and under 18 years		10			1									2									5			2				
18 and under 20 years		29			3									7									11			1			7	
20 and under 25 years	29	77	1	7	29		1	4		1			3	12	1	1	1		4	1			2					12	28	
25 and under 30 years	106	32	1	16	9		1	2		6			8	4	1	4	2		15	3		4						52	12	
30 and under 35 years	116	15		41	6		10	4		11			3			2	2		14						1			34	3	
35 and under 40 years	88	9	3	26	5	1	6			10			3	2		2			7			2		1	1			31	2	1
40 and under 45 years	68	4	4	19	1	3	10	2		4			2						3			1			1	1		28		1
45 and under 50 years	35	3	1	12		1	6	2		2			1			1			3			1				1		9		
50 and under 60 years	25		3	9		1	8		1							1			2									5		1
60 years and over	4		2	1			1		1																1			1		1
Total	[1] 473	180	15	131	54	6	43	14	2	34	....	....	20	27	2	11	5	....	48	4	....	8	19	1	4	5	....	[1] 174	52	4
YEARS OF SERVICE.																														
Under 2 years	28	25	1	1	1		1	1					1	1		1			1			2	6					21	16	1
2 and under 3 years	19	21		2	2		2	2		1			2	4			1						3			1		12	8	
3 and under 4 years	15	15	1		2					1				2		1	1						2	1		1		13	7	
4 and under 5 years	14	17		1	2								1	3					1			1	4			1		10	7	
5 and under 10 years	131	60	3	20	25	1	2	3		8			3	10	1	2	2		27	2		2	4		1	1		66	13	1
10 and under 15 years	134	29	1	50	15		7	5		17			7	5	1	5	1		12	2		1						35	1	
15 and under 20 years	48	7	3	20	2	1	9	2	1	3			3	2		1			3						1	1		8		1
20 and under 25 years	49	5	4	23	5	3	8			4			2						2			1			1			8		1
25 and under 30 years	20	1	2	8		1	7	1	1				1						2						1			1		
30 and under 35 years	13			5			6									1						1								
35 years and over	2			1			1																							
Total	473	180	15	131	54	6	43	14	2	34	....	....	20	27	2	11	5	....	48	4	....	8	19	1	4	5	....	174	52	4

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[1] Including 2, age not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF WORKMEN OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO SKILL, NATIVITY AND CONJUGAL CONDITION—Continued.

MERCHANT MILL DEPARTMENT.

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees.									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																														
Under 16 years																														
16 and under 18 years																														
18 and under 20 years																														
20 and under 25 years	2	4									1								1	1								1	2	
25 and under 30 years	7	5		1						1	1								1	2								4	2	
30 and under 35 years	9	2		1						3	1					1			2									2	1	
35 and under 40 years	6	4		1	1		3	1		1									1	2										
40 and under 45 years	4	1	1				3	1				1																1		
45 and under 50 years	3						3																							
50 and under 60 years	3						3																							
60 years and over	1		1				1																	1						
Total	35	16	2	3	1		13	2		5	3	1				1			5	5				1				8	5	
YEARS OF SERVICE.																														
Under 2 years	1	1																		1								1		
2 and under 3 years	1	3														1				1									2	
3 and under 4 years		1									1																			
4 and under 5 years																														
5 and under 10 years	10	5	1							2	1	1							3	1								5	3	
10 and under 15 years	8	1		1			2			2	1								2									1		
15 and under 20 years	5	1		2			1			1										1								1		
20 and under 25 years	5	2			1		5	1																						
25 and under 30 years	4	1					4													1										
30 and under 35 years	1	1	1				1	1																1						
35 years and over																														
Total	35	16	2	3	1		13	2		5	3	1				1			5	5				1				8	5	

STEAM DEPARTMENT.

AGE.																														
Under 16 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
18 and under 20 years	....	4	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	2	....	....	....	....	....	1	....
20 and under 25 years	10	22	....	....	1	....	....	....	....	....	....	....	1	5	....	....	1	....	5	2	....	....	1	....	....	....	....	4	12	....
25 and under 30 years	36	14	....	....	....	....	....	....	....	....	....	....	1	1	....	2	1	....	24	3	....	....	....	....	....	1	....	9	8	....
30 and under 35 years	33	10	....	1	....	....	1	....	....	....	....	....	3	1	....	3	4	....	15	4	....	....	....	....	....	....	....	10	1	....
35 and under 40 years	49	4	1	....	....	....	....	....	....	....	....	....	4	....	....	6	....	1	26	1	....	....	....	....	3	1	....	10	2	....
40 and under 45 years	17	....	....	....	....	....	....	....	....	....	....	....	1	....	....	3	....	....	8	....	....	....	....	....	....	....	....	5	....	....
45 and under 50 years	26	4	1	....	1	....	....	....	....	....	....	....	3	....	....	8	1	....	6	1	....	....	....	....	2	....	1	7	1	....
50 and under 60 years	24	2	4	2	....	....	....	....	....	....	....	....	3	....	1	13	1	2	1	1	1	....	....	....	....	....	....	5	....	....
60 years and over	13	....	....	....	....	....	1	....	....	....	....	....	3	....	....	7	....	....	....	....	....	....	....	....	1	....	....	1	....	....
Total	[1] 209	60	6	3	2	....	2	....	....	....	....	....	19	8	1	42	8	3	[1] 86	12	1	....	3	....	6	2	1	51	25	....
YEARS OF SERVICE.																														
Under 2 years	3	7	....	....	....	....	....	....	....	....	....	....	1	1	....	....	1	....	1	....	....	....	....	....	....	....	....	1	5	....
2 and under 3 years	8	12	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	2	2	....	....	1	....	....	....	....	6	8	....
3 and under 4 years	10	4	....	....	....	....	....	....	....	....	....	....	2	1	....	....	....	....	2	....	....	....	2	....	2	....	....	4	1	....
4 and under 5 years	6	7	....	1	....	....	....	....	....	....	....	....	....	1	....	....	1	....	3	1	....	....	....	....	....	....	....	2	4	....
5 and under 10 years	57	18	....	....	1	....	....	....	....	....	....	....	1	2	....	2	2	....	36	6	....	....	....	....	....	1	....	18	6	....
10 and under 15 years	49	5	2	....	....	....	1	....	....	....	....	....	8	2	....	5	....	2	25	2	....	....	....	....	....	....	....	10	1	....
15 and under 20 years	34	4	2	....	....	....	....	....	....	....	....	....	6	....	1	7	3	....	14	1	1	....	....	....	1	....	....	6	....	....
20 and under 25 years	19	2	2	....	1	....	....	....	....	....	....	....	1	....	....	12	....	1	3	....	....	....	....	....	....	1	1	3	....	....
25 and under 30 years	12	1	....	....	....	....	....	....	....	....	....	....	....	....	....	8	1	....	....	....	....	....	....	....	3	....	....	1	....	....
30 and under 35 years	7	....	....	1	....	....	....	....	....	....	....	....	....	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....
35 years and over	3	....	....	1	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	[2] 209	60	6	3	2	....	2	....	....	....	....	....	19	8	1	[2] 42	8	3	86	12	1	....	3	....	6	2	1	51	25	....

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[1] Including 1, age not reported.

[2] Including 1, years of service in iron and steel industry not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF WORKMEN OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO SKILL, NATIVITY, AND CONJUGAL CONDITION—Continued.

ELECTRIC LIGHT AND POWER DEPARTMENT.

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees.									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																														
Under 16 years	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....
16 and under 18 years	....	4	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....
18 and under 20 years	....	6	....	....	....	....	....	....	....	....	....	....	....	5	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....
20 and under 25 years	15	32	....	3	8	....	....	....	....	....	....	....	5	14	....	....	3	....	6	2	....	1	2	....	....	2	....	....	1	....
25 and under 30 years	39	22	....	10	8	....	1	2	....	....	....	....	11	4	....	5	6	....	11	2	....	....	....	....	....	....	....	1	....	....
30 and under 35 years	33	3	1	12	2	1	3	....	....	....	....	....	8	1	....	6	....	....	3	....	....	....	....	....	1	....	....	....	....	....
35 and under 40 years	15	6	1	3	2	....	3	1	....	....	....	1	1	3	....	4	....	....	4	....	....	....	....	....	....	....	....	....	....	....
40 and under 45 years	11	1	....	2	....	....	3	....	....	....	....	....	2	1	....	1	....	....	3	....	....	....	....	....	....	....	....	....	....	....
45 and under 50 years	3	....	....	2	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
50 and under 60 years	5	2	....	1	1	....	2	....	....	....	....	....	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
60 years and over	2	....	1	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....
Total	123	77	3	34	21	1	13	3	....	....	....	1	30	31	....	16	9	....	27	4	....	1	6	....	1	2	1	1	1	....
YEARS OF SERVICE.																														
Under 2 years	6	14	....	2	1	....	....	....	....	....	....	....	2	6	....	1	2	....	....	....	....	1	4	....	....	1	....	....	....	....
2 and under 3 years	5	10	....	....	1	....	1	....	....	....	....	....	1	5	....	2	2	....	....	....	....	....	1	....	....	....	....	1	1	....
3 and under 4 years	4	7	....	....	1	....	....	....	....	....	....	....	1	3	....	1	1	....	2	1	....	....	1	....	....	....	....	....	....	....
4 and under 5 years	10	10	....	4	5	....	1	....	....	....	....	....	2	3	....	1	1	....	1	....	....	....	....	....	1	1	....	....	....	....
5 and under 10 years	39	23	....	10	7	....	2	....	....	....	....	....	9	12	....	4	1	....	14	3	....	....	....	....	....	....	....	....	....	....
10 and under 15 years	33	10	1	11	4	1	1	2	....	....	....	....	9	2	....	5	2	....	7	....	....	....	....	....	....	....	....	....	....	....
15 and under 20 years	16	1	1	3	1	....	5	....	....	....	....	....	5	....	....	1	....	....	2	....	....	....	....	....	....	....	1	....	....	....
20 and under 25 years	8	2	1	4	1	....	1	1	....	....	....	1	1	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....
25 and under 30 years	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
30 and under 35 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
35 years and over	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	123	77	3	34	21	1	13	3	....	....	....	1	30	31	....	16	9	....	27	4	....	1	6	....	1	2	1	1	1	....

TRANSPORTATION DEPARTMENT.

AGE.																														
Under 16 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
18 and under 20 years	1	9	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	1	....	....	....	3	....	....	....	....	....	2	....
20 and under 25 years	23	76	1	4	16	....	....	2	....	....	....	....	10	43	....	1	1	....	6	5	1	....	3	....	....	....	....	2	6	....
25 and under 30 years	58	33	....	29	22	....	2	4	....	2	1	....	9	3	....	3	....	....	7	....	....	1	2	....	....	....	....	5	1	....
30 and under 35 years	48	8	2	32	6	1	7	2	....	1	....	....	5	....	1	....	....	....	1	....	....	....	....	....	....	....	....	2	....	....
35 and under 40 years	61	10	1	37	4	....	8	1	....	1	....	....	10	3	....	3	1	....	2	....	....	....	1	....	....	....	....	....	....	1
40 and under 45 years	22	6	....	16	5	....	2	....	....	1	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....
45 and under 50 years	13	2	1	9	1	....	1	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
50 and under 60 years	13	....	3	11	....	2	2	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
60 years and over	4	....	....	2	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	243	[1] 145	8	140	54	3	22	9	....	5	1	....	39	[1] 55	2	8	2	....	17	5	1	1	9	....	....	....	....	11	10	2
YEARS OF SERVICE.																														
Under 2 years	12	16	....	9	8	....	....	....	....	....	....	....	3	6	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....
2 and under 3 years	8	11	....	4	1	....	....	1	....	....	....	....	2	5	....	....	....	....	1	....	....	....	1	....	....	....	....	1	3	....
3 and under 4 years	5	12	....	3	3	....	....	....	....	....	....	....	2	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....
4 and under 5 years	17	13	....	10	2	....	....	1	....	....	....	....	5	7	....	1	....	....	....	2	....	....	....	....	....	....	....	1	1	....
5 and under 10 years	61	58	3	21	14	1	8	5	....	1	1	....	13	25	....	3	1	....	9	3	1	1	6	....	....	....	....	5	3	1
10 and under 15 years	64	19	....	40	17	....	4	....	....	2	....	....	8	1	....	1	....	....	6	....	....	....	1	....	....	....	....	3	....	....
15 and under 20 years	26	8	3	22	3	1	2	1	....	1	....	....	1	2	2	....	1	....	....	....	....	....	....	....	....	....	....	....	1	....
20 and under 25 years	35	7	1	20	5	....	5	1	....	1	....	....	4	1	....	3	....	....	1	....	....	....	....	....	....	....	....	1	....	1
25 and under 30 years	8	1	....	5	1	....	2	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
30 and under 35 years	5	....	1	4	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
35 years and over	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	[2] 243	145	8	[2] 140	54	3	22	9	....	5	1	....	39	55	2	8	2	....	17	5	1	1	9	....	....	....	....	11	10	....

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[1] Including 1, age not reported.

[2] Including 1, years of service in iron and steel industry not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF WORKMEN OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO SKILL, NATIVITY, AND CONJUGAL CONDITION—Continued.

MECHANICAL DEPARTMENT.

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees.									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S	W.
AGE.																														
Under 16 years	....	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years	....	16	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	11	....	....	1	....	....	1	....
18 and under 20 years	....	49	....	....	2	....	....	....	....	....	....	....	....	10	....	....	3	....	....	4	....	....	23	....	....	3	....	....	4	....
20 and under 25 years	63	150	....	11	21	....	5	3	....	1	4	....	11	42	....	2	4	....	28	65	....	2	10	....	....	2	....	3	8	....
25 and under 30 years	149	57	1	24	10	....	14	12	....	19	1	....	14	8	1	5	5	....	62	15	....	2	1	....	1	1	....	8	4	....
30 and under 35 years	145	20	3	33	3	....	20	3	....	22	1	....	10	3	1	4	4	....	41	4	....	....	1	....	1	1	....	14	....	2
35 and under 40 years	129	13	2	37	3	1	25	2	....	9	1	....	11	1	1	6	3	....	27	1	....	....	....	....	1	....	....	13	2	....
40 and under 45 years	93	8	3	22	4	1	15	2	1	13	....	....	4	1	....	9	1	1	20	....	....	2	....	....	1	....	....	7	....	....
45 and under 50 years	57	6	7	8	1	2	17	3	2	7	....	....	9	....	....	6	....	....	7	....	2	....	1	....	1	1	1	2	....	....
50 and under 60 years	71	2	10	21	1	3	28	....	3	1	....	....	6	1	....	5	....	1	4	....	....	2	....	1	....	....	2	4	....	....
60 years and over	17	....	3	3	....	1	4	....	2	1	....	....	1	....	....	4	....	....	....	....	....	2	....	....	2	....	....	....	....	....
Total	724	[1] 332	29	159	45	8	128	25	8	73	7	....	66	70	3	41	20	2	189	[1] 90	2	10	47	1	7	9	3	51	19	2
YEARS OF SERVICE.																														
Under 2 years	48	58	1	9	....	....	8	1	....	....	....	....	8	15	1	4	4	....	12	15	....	....	11	....	1	3	....	6	9	....
2 and under 3 years	34	51	....	4	4	....	3	2	....	1	1	....	5	7	....	2	5	....	12	18	....	....	10	....	1	1	....	6	3	....
3 and under 4 years	24	43	....	8	1	....	2	1	....	....	1	....	1	12	....	1	1	....	12	18	....	....	7	....	....	....	....	....	2	....
4 and under 5 years	34	34	1	6	2	1	1	6	....	....	....	....	5	6	....	2	1	....	16	12	....	1	6	....	....	1	....	3	....	....
5 and under 10 years	179	100	5	34	18	....	17	5	....	16	5	....	16	24	2	4	6	1	73	22	....	3	12	....	1	3	1	15	5	1
10 and under 15 years	184	31	4	49	14	1	20	4	....	40	....	....	16	4	....	4	3	....	40	5	2	1	1	....	1	....	....	13	....	1
15 and under 20 years	73	5	4	21	2	2	20	2	1	7	....	....	1	1	....	6	....	....	11	....	....	2	....	....	1	....	1	4	....	....
20 and under 25 years	77	8	2	16	2	....	22	4	....	6	....	....	8	1	....	8	....	1	12	....	....	1	....	1	1	1	....	3	....	....
25 and under 30 years	34	....	3	8	....	1	15	....	2	1	....	....	3	....	....	5	....	....	1	....	....	....	....	....	....	....	....	1	....	....
30 and under 35 years	20	1	4	2	1	2	11	....	1	1	....	....	2	....	....	3	....	....	....	....	....	1	....	....	....	....	1	....	....	....
35 years and over	17	....	5	2	....	1	9	....	4	1	....	....	1	....	....	2	....	....	....	....	....	1	....	....	1	....	....	....	....	....
Total	724	[2] 332	29	159	[2] 45	8	128	25	8	73	7	....	66	70	3	41	20	2	189	90	2	10	47	1	7	9	3	51	19	....

FOUNDRY DEPARTMENT.

AGE.																														
Under 16 years																														
16 and under 18 years		2																					1						1	
18 and under 20 years		3			1						1												1							
20 and under 25 years	4	10			1			1		1	1			2					1	3			1					2	1	
25 and under 30 years	8	3		3	2					2									3	1										
30 and under 35 years	10	4	1	2	1	1	1	1		3				1		1			1	1								2		
35 and under 40 years	12	2		4	1		1	1		1									4									2		
40 and under 45 years	5			2															2									1		
45 and under 50 years	7	1		1	1		2						1						3											
50 and under 60 years	6		1	2												1			1					1				2		
60 years and over	3		1																			1		1				2		
Total	55	25	3	14	7	1	4	3	....	7	2	....	1	3	....	2	....	....	15	5	....	1	3	2	....	....	....	11	2	....
YEARS OF SERVICE.																														
Under 2 years	5	2		1															4	1									1	
2 and under 3 years	5	5		1	1			1		1	1								1	1								2	1	
3 and under 4 years	5	3								1	1								3				2					1		
4 and under 5 years	3	2					1							1					2	1										
5 and under 10 years	10	6			2			1		3				1		1			2	1		1	1					3		
10 and under 15 years	6	5		2	3									1					2	1								2		
15 and under 20 years	10			4						2			1						1									2		
20 and under 25 years	4	1	2	1		1	1	1								1								1				1		
25 and under 30 years	2	1		2	1																									
30 and under 35 years	3			2			1																							
35 years and over	2		1	1			1																	1						
Total	55	25	3	14	7	1	4	3	....	7	2	....	1	3	....	2	....	....	15	5	....	1	3	2	....	....	....	11	2	....

[1] Including 1, age not reported.

[2] Including 1, years of service in iron and steel industry not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF WORKMEN OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO SKILL, NATIVITY, AND CONJUGAL CONDITION—Concluded.

SHIPPING DEPARTMENT AND MILL YARDS.

Age and years of service.	Number of employees.			Skilled employees.									Semiskilled employees									Unskilled employees.								
				American.			European.						American.			European.						American.			European.					
							Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																														
Under 16 years	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
16 and under 18 years	....	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13	....	....	1	....	....	3	....
18 and under 20 years	1	24	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	10	....	....	....	....	1	10	....
20 and under 25 years	11	58	....	....	6	....	....	....	....	....	....	....	2	12	....	....	2	....	1	5	....	....	6	....	....	....	....	8	27	....
25 and under 30 years	66	15	....	7	3	....	1	....	....	....	....	....	1	1	....	....	2	....	18	....	....	1	1	....	....	....	....	38	8	....
30 and under 35 years	32	9	....	....	....	....	1	....	....	....	....	....	....	....	....	....	3	....	10	....	....	1	1	....	....	1	....	20	4	....
35 and under 40 years	60	3	....	4	....	....	2	....	....	1	....	....	2	....	....	2	....	....	19	1	....	1	....	....	....	....	....	29	2	....
40 and under 45 years	34	3	....	1	....	....	2	1	....	2	....	....	....	....	....	1	....	....	10	....	....	1	....	....	....	....	....	17	2	....
45 and under 50 years	28	1	....	2	....	....	3	....	....	1	....	....	....	....	....	....	....	....	10	....	....	....	....	....	....	....	....	12	1	....
50 and under 60 years	9	1	....	....	....	....	2	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	1	....	5	....	....
60 years and over	3	....	1	1	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....
Total	244	131	1	15	9	....	11	1	1	4	....	....	7	17	....	3	7	....	69	6	....	4	31	....	1	3	....	130	57	....
YEARS OF SERVICE.																														
Under 2 years	14	39	....	....	....	....	....	....	....	....	....	....	....	4	....	....	2	....	....	....	....	....	13	....	....	1	....	14	19	....
2 and under 3 years	16	18	....	....	....	....	....	....	....	....	....	....	....	3	....	....	1	....	1	....	....	1	4	....	....	....	....	14	10	....
3 and under 4 years	10	11	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	3	....	....	....	....	9	7	....
4 and under 5 years	9	15	....	1	1	....	....	....	....	....	....	....	....	3	....	1	1	....	1	....	....	1	3	....	....	....	....	5	7	....
5 and under 10 years	70	34	....	4	4	....	2	1	....	....	....	....	1	7	....	....	2	....	22	4	....	....	8	....	....	....	....	41	8	....
10 and under 15 years	56	9	....	4	4	....	3	....	....	....	....	....	4	....	....	....	1	....	20	....	....	....	....	....	....	1	....	25	3	....
15 and under 20 years	32	3	....	4	....	....	2	....	....	3	....	....	1	....	....	1	....	....	13	1	....	....	....	....	....	....	....	8	2	....
20 and under 25 years	28	2	....	1	....	....	....	....	....	1	....	....	....	....	....	1	....	....	12	....	....	....	....	....	....	1	....	13	1	....
25 and under 30 years	5	....	1	1	....	....	2	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....
30 and under 35 years	3	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....
35 years and over	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	[1] 244	131	1	15	9	....	11	1	1	4	....	....	7	17	....	3	7	....	69	6	....	[1] 4	31	....	1	3	....	130	57	....

GENERAL YARD LABOR.

AGE.																													
Under 16 years		2																				2							
16 and under 18 years		19																				19							
18 and under 20 years		36																				25			2			9	
20 and under 25 years	27	75		1								1	4		1						7	20		4	3		13	48	
25 and under 30 years	61	32	2	1								2			1			1	1		6	5		1	6	1	49	20	1
30 and under 35 years	65	18										1			1			2			6	5		5	3		50	10	
35 and under 40 years	72	12	2				1											1			3	4		4	4	1	63	4	1
40 and under 45 years	50	4	4				1								1						2	1		10	2	3	36	1	1
45 and under 50 years	45	8	4																		4	3	1	11	4	3	30	1	
50 and under 60 years	40	4	5																		5	1		23	1		12	2	5
60 years and over	19	2	4																		4		1	12	2	3	3		
Total	[2] 380	212	21	2			2					4	4		4			4	1		37	85	2	[1] 71	27	11	256	95	8
YEARS OF SERVICE.																													
Under 2 years	37	75																			6	32		2	6		29	37	
2 and under 3 years	41	38																			2	12		2			37	26	
3 and under 4 years	19	20																			3	11		1	2		15	7	
4 and under 5 years	25	18	2									1	1								6	6		2	3		16	8	2
5 and under 10 years	88	36	3	1								2	2		1			1	1		4	15		12	6	1	67	12	2
10 and under 15 years	64	12	1	1								1	1		2			3			3	5		7	3		47	3	1
15 and under 20 years	33	5	7				1														6	2	2	5	1	3	21	2	2
20 and under 25 years	38	3	1												1						1	1		18	2	1	18		
25 and under 30 years	21	4	5																		3			12	4	4	6		1
30 and under 35 years	10		1				1														1			8		1			
35 years and over	4	1	1																		2	1		2		1			
Total	380	212	21	2			2					4	4		4			4	1		37	85	2	71	27	11	256	95	8

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[1] Including 1, years of service in iron and steel industry not reported.

[2] Including 1, age not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF SUPERVISORY AND CLERICAL EMPLOYEES OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO NATIVITY AND CONJUGAL CONDITION.

(M.=Married; S.=Single; W.=Widowed.)

Age and years of service.	Superintendents and assistant superintendents.									Foremen.									Recorders, weighmasters, etc.								
	American.			European.						American.			European.						American.			European.					
				Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																											
Under 16 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16 and under 18 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	2	.....	.....	.....	.....	.....	.....	.....
18 and under 20 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	.....	.....	.....	.....	.....	.....	.....
20 and under 25 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	.....	2	1	.....	.....	.....	.....	5	28	.....	.....	1	.....	1	1	.....
25 and under 30 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	8	.....	1	.....	.....	2	1	.....	2	15	.....	6	2	.....	.....	.....	.....
30 and under 35 years	3	.....	1	.....	1	.....	.....	.....	.....	23	3	.....	8	.....	.....	4	.....	.....	10	2	.....	4	1	.....	.....	.....	.....
35 and under 40 years	16	1	.....	.....	.....	.....	.....	.....	.....	34	1	1	16	1	.....	5	.....	.....	4	1	.....	1	.....	.....	.....	.....	.....
40 and under 45 years	8	.....	1	4	.....	.....	.....	.....	.....	23	1	1	10	.....	.....	5	.....	.....	2	.....	.....	4	.....	.....	.....	.....	.....
45 and under 50 years	3	.....	1	3	.....	.....	.....	.....	.....	10	2	1	16	.....	1	2	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....
50 and under 60 years	3	.....	.....	.....	.....	.....	.....	.....	.....	10	1	2	7	1	.....	1	.....	.....	4	.....	.....	3	.....	1	.....	.....	.....
60 years and over	1	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	4	1	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....
Total	34	1	3	7	1	.....	.....	.....	.....	113	24	5	64	4	2	19	1	.....	30	60	.....	[1] 19	4	1	1	1	.....
YEARS OF SERVICE.																											
Under 2 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1	.....	.....	.....	.....	.....	.....	.....	1	5	.....	.....	.....	.....	1	.....	.....
2 and under 3 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	1	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	1	.....	.....	.....
3 and under 4 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	1	4	.....	1	.....	.....	.....	.....	.....
4 and under 5 years	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	4	.....	.....	.....	.....	1	.....	.....	2	7	.....	1	.....	.....	.....	.....	.....
5 and under 10 years	.....	1	1	.....	.....	.....	.....	.....	.....	8	7	.....	5	1	.....	2	.....	.....	11	28	.....	.....	2	.....	.....	1	.....
10 and under 15 years	4	.....	.....	1	1	.....	.....	.....	.....	28	6	.....	8	1	2	8	1	.....	2	12	.....	8	1	.....	.....	.....	.....
15 and under 20 years	8	.....	.....	.....	.....	.....	.....	.....	.....	28	2	1	16	.....	.....	4	.....	.....	4	1	.....	2	1	.....	.....	.....	.....
20 and under 25 years	15	.....	1	2	.....	.....	.....	.....	.....	25	1	1	21	.....	.....	3	.....	.....	9	1	.....	4	.....	.....	.....	.....	.....
25 and under 30 years	2	.....	1	3	.....	.....	.....	.....	.....	11	.....	1	6	1	.....	1	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....
30 and under 35 years	2	.....	.....	.....	.....	.....	.....	.....	.....	3	1	1	7	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
35 years and over	3	.....	.....	1	.....	.....	.....	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	34	1	3	7	1	.....	.....	.....	.....	113	24	5	[2] 64	4	2	19	1	.....	30	60	.....	19	4	1	1	1	.....

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[1] Including 1, age not reported.

[2] Including 1, years of service in iron and steel industry not reported.

Age and years of service.	Clerks, stenographers, etc.									Messengers.									Helpers to chemists.								
	American.			European.						American.			European.						American.			European.					
				Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																											
Under 16 years		1									27			2			3										
16 and under 18 years	1	7									35						3			7							
18 and under 20 years		37			1						4									16			1				
20 and under 25 years	11	68			2			1											5	26			2			1	
25 and under 30 years	24	33	2	2	4		1			1									9	10			2			2	
30 and under 35 years	29	6		8	4														11	2		1	2			1	
35 and under 40 years	25	9	1	5														1	5	1							
40 and under 45 years	20	1	1	4															3	1			1				
45 and under 50 years	9			5															1			2					
50 and under 60 years	13	4	2	3		1													2								
60 years and over	4	1		1		1													1								
Total	136	167	6	[1] 29	11	2	1	1		1	66			2			6	1	37	63		3	8			4	
YEARS OF SERVICE.																											
Under 2 years	12	37	1		2						46			2			5		1	20						2	
2 and under 3 years	10	32		1							14						1		2	10							
3 and under 4 years	3	11		1	1						3								1	6							
4 and under 5 years	7	15		1	1						2								3	6			1				
5 and under 10 years	33	46	2	4	5			1		1								1	14	17		1	2			1	
10 and under 15 years	30	17	2	7	1		1												6	1		1	2			1	
15 and under 20 years	15	3		8	1	1													6	1			2				
20 and under 25 years	23	2		2															3	2			1				
25 and under 30 years	1	3		1																							
30 and under 35 years	2	1	1	4		1																					
35 years and over																			1			1					
Total	136	167	6	29	11	2	1	1		1	[2] 66			2			6	1	37	63		3	8			4	

[1] Including 1, age not reported.

[2] Including 1, years of service in iron and steel industry not reported.

AGE AND YEARS OF SERVICE IN THE IRON AND STEEL INDUSTRY OF SUPERVISORY AND CLERICAL EMPLOYEES OF A LARGE REPRESENTATIVE STEEL PLANT, CLASSIFIED ACCORDING TO NATIVITY AND CONJUGAL CONDITION—Concluded.

Age and years of service.	Police.									Janitors, storekeepers, etc.								
	American.			European.						American.			European.					
				Western and northern.			Eastern and southern.						Western and northern.			Eastern and southern.		
	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.	M.	S.	W.
AGE.																		
Under 16 years																		
16 and under 18 years																		
18 and under 20 years																		
20 and under 25 years							1			1	1					1	1	
25 and under 30 years	1				2						1							
30 and under 35 years	4	1		3			1			1	1	1				1		
35 and under 40 years	5			5						4	1	1						
40 and under 45 years	3	1		5						4		1	1			2		
45 and under 50 years	2		1	8	1					1						2		
50 and under 60 years	6			6			1			1		1	2				1	
60 years and over	4					1				1		1	1					
Total	25	2	1	27	3	1	3			13	4	5	4			6	2	
YEARS OF SERVICE.																		
Under 2 years	6	1									1							
2 and under 3 years										2	2						1	
3 and under 4 years										1								
4 and under 5 years				1	1													
5 and under 10 years	1			3	1		3			4	1	1	1			2		
10 and under 15 years	4		1	4		1				3		1	1			2		
15 and under 20 years	1			2						1		2				1		
20 and under 25 years	4	1		8	1					2						1	1	
25 and under 30 years	4			3									2					
30 and under 35 years	1			3														
35 years and over	4			3								1						
Total	25	2	1	27	3	1	3			13	4	5	4			6	2	

APPENDIX D.—EXTRACTS FROM MINUTES OF EXECUTIVE COMMITTEE OF UNITED STATES STEEL CORPORATION.

The following extracts from the minutes of the executive committee of the United States Steel Corporation are reprinted from the Hearings before the Committee on Investigation of the United States Steel Corporation, House of Representatives, pages 3819 to 3833. These extracts include all the references to labor matters. For discussion see page 116.

APRIL 20, 1901.

NEWSPAPER INTERVIEWS CONCERNING RELATION OF THIS COMPANY TO CONSTITUENT COMPANIES.

Mr. Edenborn thinks it expedient to inform the newspapers and the public generally that the United States Steel Corporation is not the one employer, but that the individual companies are distinct and separate for themselves; that the labor troubles of any one company must be settled by that particular company as an individual company, and a strike in one must be settled independently of any other company.

This brought a discussion of the labor situation.

It was suggested that we might make some sort of agreement with a certain association which is very strong in certain of our companies to the effect that those companies might deal with the association with reference to their own forces, if they would let other industries alone. It was then intimated that the association might not keep faith, but the experience of one member of the committee was that it was probable they would keep the agreement. Attention was called to the fact that certain newspapers seem to publish any and everything that will create sufficient sentiment to influence newspaper sales; that we ought to do all we reasonably can to keep public sentiment right and the facts before the public. It was the opinion of one member that he would like to have the workmen understand that we do not purpose to allow them to run our mills, but that we do purpose always to treat the men fairly as individuals and give them good, liberal wages.

Returning to Mr. Edenborn's proposition, the comment was made that we can make the public understand that the United States Steel Corporation has no power to direct the policies of all companies; but that we can let the public and employees understand that while this company owns the stock of the different companies it will not say anything to them but that they must all stand for themselves.

One member believes that we will have to recognize the labor unions everywhere sooner or later and that they are here to stay. It was then said that even now you must recognize them in certain of our companies where they are very strong.

At the close of this whole discussion it was decided that the sense of this committee is that the general policy should be to temporize for the next six months or year until we get fully established, and that the prevalent conditions of labor and labor unions at the different plants should be undisturbed, and that if any changes do occur later they can be handled individually.

LABOR DISCUSSION.

There was a protracted talk on the subject of labor and particularly as to its bearing upon the future workings of this corporation.

Three members of the committee have very positive ideas on the expediency of permitting any change in the labor relations now prevailing at the different plants. They insist that they believe we must accept whatever conditions now exist at our plants; that it is not wise at this time to institute any change ourselves; that any attempt on the part of anyone else to bring about an alteration in a certain direction should be promptly discouraged by the ordinary means; that if it is found and desired that changes be brought about later by our companies they can be done when business reasons would permit. These gentlemen further maintain that long experience in these matters has taught them that if certain situations which naturally arise from time to time be not quickly disposed of on the spot with a firm hand, you will then witness the beginning of the end. They believe there are times when you must not tolerate the first step in the wrong direction to be taken at all; that this matter be decided promptly by the manager on the spot who must be given authority to act in such matter in accordance with his judgment of the situation; that there is no time for consultation in many instances, and when that is the situation the manager should have the authority to assert himself and be backed up here when he reports his action.

They favored the prompt reporting here of any trouble and stated that matters that were serious or are likely to cause trouble should be handled upon the advice of this committee. They do not approve of the local manager attempting to decide any and all questions of this kind that may arise at the plant, but these small affairs that require nipping in the bud should be disposed of by him and then report here. They believe that where a matter will keep without detriment he should not decide the question but communicate fully to this office.

One of the three gentlemen holding the above opinion stated that he favors finessing this whole situation; that we should continue any condition we receive as our heritage and let it remain quietly in the present state, but hold fast to the present status of things at the different plants.

The other members of the committee expressed themselves about as follows:

One gentleman believes that at first intimation of any trouble the president of this company should be promptly and fully informed and let this committee consider it and give its advice; that the presidents give no decision until they have a chance to get views of headquarters before any stand is decided upon. He thinks this whole question is so big and grave in its possible effect to the United States Steel Corporation that we ought to proceed with great caution and if necessary consult with some of our associates on the subject. He makes the suggestion that the president of this company should ascertain whether or not the presidents believe there are any labor troubles in sight and the nature of them, and to also advise them when anything of this nature is approaching, full and explicit information should be promptly reported to the president of this company and this committee can then decide each question at that time. He believes that we can pretty clearly define the policy to the various presidents. He believes it should be our aim to learn what is fair treatment to the laboring men; that it would be a great mistake if it were understood we had adopted a policy of antagonism; that the effect might be disastrous; that we must not lose sight of the financial interests of the corporation and must endeavor to keep clear of anything that might be prejudicial to these interests.

The second member of the committee who held different views from those of the first three gentlemen, expressed himself strongly on the point of the inconsistency of recognition of certain conditions at one plant and yet we propose to discourage the installation of similar conditions elsewhere. He insists we must be consistent. He would let the men everywhere establish conditions and pay no heed to the matter unless it led to abuse, and then he would certainly approve of fighting the matter upon that ground. He offers this proposition: That we do not deny to one works what we tolerate in others.

Upon the plan of giving local presidents and managers the handling of what may appear to be petty situations he made comment that he is rather inclined to think that this power should not be put in the hands of the local officers on the ground that there is strong probability of it some time involving this company in very serious labor troubles. The further discussion of this whole matter was finally laid over for another session.

May 2, 1901.

LABOR DISCUSSION.

A brief report of the preceding meeting was read by the secretary and elicited no dissenting voice.

There was some further talk about on the lines of the preceding day, but nothing definite decided upon.

The committee decided that they would not submit the matter to the board of directors at the present time.

May 13, 1901.

LABOR MATTERS—VESSELS ON LAKES.

The president reports that on Saturday and Sunday he was in communication with Mr. Wolvin, who feared that he would be unable to start out the boats this morning unless prompt assent were given to the demand made by the engineers on the steamers on the lake for additional help. The president stated that it was a matter for quick decision, and inasmuch as other vessel interests had agreed to the demand, there was nothing to do, he believed, but to tell Mr. Wolvin to agree.

Upon motion the action of the president in the premises was approved.

MAY 23, 1901.

LABOR SITUATION.

The president stated that he sees no reason to change the opinion heretofore expressed by him. He believes that when the labor scales are presented later they should be accepted if reasonable and go ahead with our work.

MAY 28, 1901.

LABOR.

The president informed the committee that he has been recommending to the presidents of the subsidiary companies the pursuance of the policy outlined at this committee by the president at previous discussions in these meetings, and stated that while he was under the impression that while there was no actual vote recorded upon the subject, yet he knew of no dissenting opinion of the committee as a whole, and therefore had proceeded in several instances along the lines suggested. He thinks it better to have a formal vote of the committee recorded, and therefore brings up the matter.

Upon motion it was voted that the committee do hereby approve of the action taken by the president heretofore, and recommends that it pursue the same policy in the future.

JUNE 3, 1901.

LABOR.

The president reports that he has had a talk with the presidents of the subsidiary companies with reference to the attitude of organized labor, and has learned from reports of the meeting of the association in Milwaukee that it has been decided to make no material changes in the scale.

The president stated that he has recommended that the presidents of the constituent companies sign the scale for mills where the association is established, providing the scales were reasonable; that he has recommended to them that the present condition of things be maintained at all their mills.

JUNE 17, 1901.

LABOR.

The president asked the committee for its opinion as to the recommendation he should make to the presidents of the subsidiary companies regarding the attitude they should maintain toward the association when the scales are presented, and further with respect to any differences that might arise owing to the probability of the association intending to extend its organization into nonunion works. As the presidents were then in session, Mr. Schwab desired to talk to them about the matter.

The president believes that our policy should be to recognize the unions where they now exist, but to refuse to deal with them in respect to any plant that is now nonunion. The president informs the committee of it being assured that any and all their nonunion works can be maintained as heretofore; and that as to the latter mills, they would refuse to treat with the association if scales or propositions were presented for such works. The president is of the opinion that when the presidents get back they ought to be in a position to know exactly what our policy is and be able to take the matter into their own hands.

There was considerable discussion on this subject, and finally the chairman stated as follows:

The first question to consider is, What, if any, answer should be made if the association sends representatives to this company direct? So far as we understand, this committee is in favor of saying to such representatives that this is a question that pertains to the business of the local company, and we do not undertake to instruct or interfere with the business of the subsidiary companies. This corporation is but a stockholder, and only intends to advise, the same as any stockholder.

The next question is, Should we establish a rule and announce that rule to presidents, viz, that they are authorized to take up the question and dispose of it promptly on the basis that under no circumstances will any union be recognized where there are no unions? It has been suggested by some of the presidents that they ought to have this authority, feeling that they are authorized to take that position and adhere to it. It has been suggested in this committee that when that question comes up the president of the subsidiary company should reply that he wished to consider and would make answer the next day, and in the meantime could take it up with the president of this company, and then finally report to the representative that the matter had been carefully considered and the decision reached is so and so.

To this last proposition the president commented that it would then be perfectly clear that such president had taken it up with this corporation.

The chairman stated, however, that if he could be as certain of the attitude of the association as the president he should not have much trouble over the question.

The chairman called attention to the fact that the association has already advertised that it proposes to deal with the subsidiary companies of the corporation as one proposition, and they purpose to extend the unions into all of the works in which the corporation is interested; that it was stated at the meeting of the presidents that if that position was adhered to and met opposition the association would very likely order a strike in all of the union mills.

The president believes such a strike to be remote possibility, and in this Mr. Reid and Mr. Converse agree with the president.

The chairman observed that if they were wrong there is a possibility of a big strike.

Mr. Converse feels that public opinion would be with us inasmuch as we had not attempted to crush unions but had simply accepted the various situations as they were; that we had left the management at the individual plants just as heretofore and advised the local officers to use their judgment. He pointed out that we are assured by certain presidents that they can run everything in their nonunion plants. He firmly believes that the association would never attempt to call out their men at the plants; that if such were the case he would be in favor of running all we can and feels certain that the final result would be entirely in our favor.

In brief, the position of Mr. Roberts is that if the representatives come to this corporation they shall be referred to the local company; that the president should not arbitrarily decide, but rather state that the matter would be considered and an answer given later; that then it could be taken up by the local board and considered. Mr. Roberts does not believe in establishing a hard and fast rule until we know what the association wants. When the matter is actually presented they can then come to a decision. We can then be positive as to just what is fair and what ought to be done. In other words, Mr. Roberts does not approve of instructing the president to do something before they reach the bridge.

The president informs the committee that there is in the air a well defined feeling that the corporation is indifferent as to fighting the extension of the labor unions.

On a vote being asked, on the question of whether or not the members of the committee would approve of fighting the thing out if a general strike were ordered, of the members the majority voted affirmatively, one did not vote, another voted in the negative. Another member stated in reply that he would vote in favor of not recognizing labor unions anywhere but feels that if 50 per cent of the works were union it would be rather inconsistent not to recognize them in the other 50 per cent.

After some further discussion Mr. Converse put this proposition:

That as a matter of fact it is not a question of finessing the situation except up to a certain point; that the very worst the association can do is with about 33⅓ per cent and he believes it will not do it with that low percentage; that if our president says to the presidents that they will please understand that the United States Steel Corporation is a large financial institution and it expects you to go ahead now and handle this situation just exactly as if the United States Steel Corporation did not exist, they will be very careful not to get into trouble.

This met the unqualified approval of the president, Mr. Steele, and Mr. Reid.

Mr. Roberts objects to the situation being thrust upon us that fast. Before the association comes forward, we should make a positive announcement as to what we would do or not do. The following suggestion brought forth by Mr. Steele was finally voted upon and the president instructed to convey it to the president[s] (i. e. of the subsidiary companies):

That we are unalterably opposed to any extension of union labor and advise subsidiary companies to take firm position when these questions come up and say that they are not going to recognize it, that is, any extension of unions in mills where they do not now exist; that great care should be used to prevent trouble and that they promptly report and confer with this corporation.

JUNE 25, 1901.

LABOR MATTERS.

The president stated that quite a number of questions have arisen between the various presidents and himself since the last meeting of the presidents and he had disposed of such questions as they came up in accordance with our previous position.

The president believes the labor question is in splendid shape; that it is his information that we are going through this trying period of the first of July without any serious trouble. It is probable that we may have some trouble with the American Sheet Steel Co., but chances are we will have no difficulties.

The president stated that Mr. Buffington, president of the Illinois Steel Co., wanted to take pretty radical measures with certain of his merchants mills, but the president advised him not to do so. The president stated that the Republic Steel Co. had asked him to postpone acceptance of scale until the first week of July, but that he had refused. He stated that the association appears to be a little slow in presenting scales.

JULY 1, 1901.

LABOR.

The president reported that the scales of the association were signed for the American Tin Plate Co., that the demand was made of the sheet company, that all of the mills of the company, union and nonunion, should sign the scale; that they then sent for the manager of the hoop company and notified him to the same effect. The managers of the sheet and hoop companies declined to sign for nonunion mills, and the consequence is but 50 per cent of the sheet and 60 per cent of the hoop and 75 per cent of the National Steel Mills were running this morning. All of the tin-plate as well as the mills of the other companies were running. The union mills of the sheet and hoop companies were out. The scales have not been presented to the National.

The question now before the committee was as to the action now to be taken. The president, Mr. Converse, Mr. Edenborn, and Mr. Steele thought it would be well to take no action, thinking that the association has a weak stand and that our position is a very good one, inasmuch as no arbitrary stand has been taken by the companies, but simply a proposal to continue business this year the same as last; that is, signing the scales for the union mills only. The president thought that the very worst that could happen would be the calling out of our nonunion men on a sympathetic strike, but he believed that there was a very remote chance of the association being able to do so. Mr. Roberts is doubtful about some of the mills reported as nonunion; he fears that there are a great many union men scattered through them. Mr. Roberts stated his position again as to the inconsistency of signing the union scales in 50 per cent and refusing to sign in the balance. He states that if the union is a bad thing, wipe it out, and that it is a sign of weakness to do otherwise. Mr. Steele pointed out that Mr. Shaffer has no standing whatever when he asks that scales be signed for nonunion men because he is not a representative.

There was no definite action deemed necessary to be taken at this meeting regarding the situation, and the subject was laid over until the next meeting, when it was probable the president may have some report. Mr. Roberts believed that the presidents of the companies interested should have been on the scene rather than allowed negotiations to be conducted by the mill superintendents. The chairman was not so sanguine as the president regarding the outcome and believed that we should be kept fully posted as to conditions.

JULY 2, 1901.

LABOR.

The president presented a letter from Mr. T. J. Shaffer, president of the Amalgamated Association, addressed to Mr. Warner Arms, vice president of the American Tin Plate Co., in which the statement was made that if the matter of dispute in the sheet and hoop companies was not adjusted by the 8th instant, he would call out the men in the mills of the tin plate and others who had already agreed to the scales. The president called for opinions of the committee as to whether or not the members would be in favor of conceding the three mills to the association. The chairman answered in the affirmative and stated that in his opinion it would be a pretty good way out of a bad thing, and thinks that this is the very worst time of the very worst year to have any trouble. Mr. Reid concurs in this. Mr. Converse is not averse to letting them have the mills above referred to, because it is a good way out of a bad situation. Mr. Edenborn would not give way one inch. Mr. Roberts stated that he would fully agree with Mr. Edenborn or he would be willing to concede any nonunion mills in companies that now have any union mills, or he would vote in favor of wiping out the whole thing in all the mills, but believes under the condition to-day it would be advisable not to do so. Mr. Edenborn stated that a concern operating with a union is pretty badly handicapped. The president suggested the advisability of sending Mr. Preston to Pittsburgh to-night to size up the situation and see whether or not he can draw any conclusion as to the advisability of our considering the concession of these three mills.

It was finally decided to defer the discussion of the subject until after the regular scheduled meeting of the board of directors of this company to be held this afternoon.

LABOR.

There was presented to the meeting a rough draft of letter drawn by Mr. Steele embodying an answer it was proposed to send to Mr. Shaffer over the signature of Mr. Arms in reply to his letter.

It was the general opinion of the members present that while the answer was good in main, yet it should be modified in certain respects. It was finally suggested that the chairman dictate another letter, which was done, and met the approval of the committee present. Upon motion, the president was instructed to advise Mr. Arms to write a letter in accordance with copy handed to the president. It having been learned that Mr. Arms left the office for the day, the president stated he would see him the next day, hand him the copy, and give him such instructions as the committee desired.

Mr. Edenborn is of the impression that we should stand where we are to-day. Mr. Reid believes if we take that position the tin workers would be called out, and we really ought to be careful what we do this year. The chairman stated that he would be willing to concede two mills as union mills, to sign the scale for the McKeesport mill and to keep it shut down.

JULY 2, 1901.[1]

Mr. Roberts stated that in his opinion you will have to face the situation next year and determine whether you are going to have union labor in all of your mills or not, and that if the present is not the time to do it it had better be done next year. The chairman stated that probably the men would be satisfied if they gained a point; that while it is very humiliating, nevertheless it is a critical period and we had better temporize if it can be done. Mr. Reid and Mr. Converse are in favor of sending Mr. Preston to Pittsburgh.

JULY 3, 1901.

LABOR.

The president reported that everything remains the same as yesterday; that he had a little talk with Mr. Arms on the line of the letter previously mentioned.

It was the opinion of the members of the committee who were acquainted with Mr. Arms that he is the right man to go and see Mr. Shaffer and find out what he wants and bring about an opening, so that if possible or necessary Mr. McMurtry and Mr. Shaffer could be brought together. The matter was left pending the report of Mr. Arms to be made later of the talk he expects to have over the telephone with Mr. Shaffer.

JULY 3, 1901.

LABOR.

Mr. Reid reported that he had just talked with Mr. Arms over the telephone. The latter stated that Mr. Shaffer told him over the telephone that he was very sorry to have to take the action indicated and would be very glad to see Mr. Arms when he came to Pittsburgh.

JULY 6, 1901.

LABOR.

The president reported that Mr. Warner Arms had gone to Pittsburgh and, on the basis last spoken of at our last meeting, had quite a lengthy interview with Mr. Shaffer with reference to the American Tin Plate Co. He did not discuss other questions with Mr. Shaffer except incidentally. The result was that the association has agreed to postpone calling out of the men at the tin-plate works providing a joint conference can be had with the representatives of the sheet, hoop, and tin-plate companies with the executive committee of the association at an early date during the coming week. Mr. Arms then stated he would take it up with those companies and ascertain if it would be agreeable to the respective companies. Mr. Arms desires to report promptly to the association, so that it might issue instructions to the men to go to work in the tin-plate mills on Monday morning, the 8th instant.

The president stated that the question to decide is whether representatives should be sent, and if so, just how they should be instructed and who should be sent. The chairman stated that it should be clearly understood that the United States Steel Corporation has nothing whatever to do with it; that the representatives of the three subsidiary companies are not to state that they are acting in concert, or even by consultation, with any of the officials of the United States Steel Corporation. Personally, the chairman thinks it wise that responsible representatives of the sheet, hoop, and tin-plate companies should act independently, but for their own companies, going together, if desired, and meet Mr. Shaffer or his committee, or both, with a view of ascertaining what the conditions are and what can be done. The chairman stated to the president that he believed men big enough to handle the situation should be sent; that they should be men in whom the president has confidence. The chairman endeavored to impress upon them the fact that each represents his own company only and believes that this is very important. The chairman thinks that either the presidents of the companies or representatives selected by the president, good men, of responsibility, and who would be satisfactory to Shaffer, should attend the conference.

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[1] Meeting held in afternoon following the meeting of board of directors.

Mr. Roberts stated that he thinks it very desirable to open negotiations, if possible, and agrees with the chairman.

Mr. Edenborn is in a little doubt whether parties representing the three companies should go together, and yet it may be wise to do so just at this time. He would instruct the men that the limit under all circumstances would be the granting of the mills that were union last year, and for which the scale was signed a year ago, and would sign for such mills now, but does not believe in conceding one iota more.

The chairman explained his opinion that the men who go should be pretty big men and able men, who if necessary might be competent to decide pretty promptly what to do; they should be men with sense enough not to be antagonistic to the views here without full consultation with New York.

Mr. Edenborn would distinctly say that they have not the right to go beyond a simple agreement with the mills in dispute, but no additional mills.

The president agrees with Mr. Edenborn except that he would not be so decided with reference to the De W. Wood mill if it came to that as a final question. The president believes that the association would not be in accord with the views of Mr. McMurtry.

In response to an inquiry from the chairman, the president stated that he had been assured by the head of the financial house that he will stand by whatever action the president thinks best. The president has also stated that the junior partners expressed themselves as very anxious to have this matter settled, but did not at any time state that it should be settled.

The chairman called attention to the fact that it seems from the statements made to be clearly understood what policy ought to be pursued.

The president stated that he thought Mr. Smith should not be sent, because it would place him in an exceedingly awkward position in view of what has already occurred. Mr. Preston, of the hoop company, he thinks, would be a very good man. The president will talk the matter over with Mr. McMurtry as to whom it would be best to send.

The chairman stated that he regards Mr. McMurtry as a very able, conscientious man; nevertheless it may be that he is so grounded in his beliefs concerning these troubles that he has been a little inclined to not volunteer to us the information concerning the two mills we ought to have. The chairman does not believe in criticism of a man in that position, every one being liable to make mistakes, yet he doubted whether Mr. McMurtry would like to go and meet the association representatives.

JULY 8, 1901.

LABOR—INSTRUCTIONS TO CONFEREES.

The president reported that Mr. Preston would have the whole matter practically in his hands and act in the capacity of chairman. It is the belief of the president that Mr. Preston is well able to handle the situation.

Mr. Converse thinks that the nature of Mr. Shaffer's utterances to the press seem to him a preparation for a let-down.

The president feels that Mr. Shaffer thinks we have made a decided concession already and that all they need to do is to stand firmly in their demands and we will accede to them. He is inclined to think that Mr. Preston will have a "pretty hard row to hoe" if he succeeds in doing business on the basis that has been outlined to him, and that if Shaffer is not talking purely for effect we may have to meet the other question.

WELLSVILLE MILL.

The president reported that the superintendent of the Wellsville sheet mill down on the Ohio River had discharged 12 men who were endeavoring to institute a lodge. Later in the meeting the chairman read an associated press dispatch referring to this and stating that the men were discharged on Saturday last and that Shaffer had announced that the men would have to be reinstated before any conference could be had.

The president stated that he then had no positive information as to the time these men were discharged, but it later developed that it was done prior to Saturday, the 6th instant. The president thinks it was done under old instructions.

Mr. Edenborn considers that any further concession to the association beyond what we have already agreed would be fatal and one of the most dangerous things to do. He believes that we have the matter well in hand and that even if we have to face a tin-plate strike we should not give in to labor.

The chairman firmly believes that if Mr. Shaffer succeeds in having the scales signed for the three mills referred to that that will settle the whole matter. He believes that we are now confronted with a situation that is certainly involved in a good deal of danger; that we may before we know it be in trouble and not able to extricate ourselves without very serious loss; that we must therefore weigh the question with care and caution and must be fully advised from time to time what is being done and what is expected to be done.

On the subject of the discharge of the 12 men the chairman stated that although the president has offered little positive opinion regarding labor unions and their extension, nevertheless he does not believe the president would have advised the discharge of these men last Saturday. To this the president agreed. The chairman then called attention to the fact that this certainly emphasizes the proposition that the superintendent of mills ought to be in constant communication with the controlling authorities of the respective companies, and that the presidents should be in constant communication with this company. The president stated that there were times when this was not feasible.

Mr. Roberts thinks we have been lacking in full and accurate information as to what the situation is in these different mills and that it seems to him that unions extend further through those mills than it was represented by the officers of the companies that they do. He fears that lodges are established through the sheet mills to a greater extent than we had supposed.

Mr. Eberborn pointed out that it took but a few men to organize and that all that were actually needed were three men. The association allows this in special cases.

PLAN OF ACTION.

On the question as to what ought to be done Mr. Reid stated that he would settle the matter on the very best terms possible and as quickly as possible and have no row now. In this the chairman and Mr. Roberts agree. Mr. Edenborn does not agree with this. Mr. Edenborn believes that it should not be a condition precedent that the 12 men taken out should be reinstated first. Let those men rest where they are. The mill is not a union mill because it has not been recognized by the owners as a union mill. If the owners of the mill had allowed lodges to be formed in this mill, had signed scales for the mill, and in every way treated with the union regarding this mill Mr. Edenborn would certainly favor the installation of the 12 men. Mr. Edenborn says that under the present conditions he would do nothing.

Mr. Converse stated that so long as negotiations were pending it could be rightfully considered by Mr. Shaffer that the removal of these men was unfair, and he would be in favor of explaining that it was a mistake.

Mr. Roberts stated that in his judgment practically all of the mills referred to were more or less union mills, and by that meant they contain more or less union labor. He therefore sees no reason or good ground why we should refuse to recognize union labor in one mill and treat with it in another. Based on the conditions which he believes exist to-day, he is in favor of making the best possible settlement we can with the amalgamated people at this time.

The chairman sums it up by saying that the questions of Mr. Reid and Mr. Roberts are not for the purpose of getting over a troublesome period, but because he believes that union labor is more or less in all these companies, and if we treat with it at all for some we should treat with all.

The president stated that he will do whatever this committee wants him to do. He stated further that he has changed his attitude because of the conditions as they exist to-day and that he would act very differently now from what he would do a week ago. He would now approve of meeting the people and making the best arrangement possible and learn what they wanted. That is, this would be up to a certain point, viz, where they demand all or nothing.

Mr. Edenborn stated that in case the negotiators offered to give them the three mills and that Mr. Shaffer should demand all or nothing the representatives should call his attention to the fact that if he called out the tin-plate works he did so at his own risk, that scales were signed by that company with full knowledge, and that they and no other broke the contract.

The chairman stated that he agrees substantially with the opinions of Mr. Roberts and Mr. Reid, as he understands them; that he is in favor of making the very best possible settlement possible, and would have been in favor a week ago if he had known the facts of recognizing the McKeesport mill, the Scottdale mill, and the Beaver Meadow mill. The chairman stated that the negotiators should not burn their bridges, so to speak; that they should be in constant communication with the president of this company, so that all interested may be fully advised of what is transpiring and anyone who wishes to give advice on the subject may be able to give it. The chairman further stated that in regard to this question when he was certain what the opinion of the majority was he would be in favor of it in every respect whether it was in harmony with his original opinion or not.

The chairman complimented the tin-plate people on the admirable management of their business, and feels that if Mr. Reid had been in charge of the business of the hoop and sheet mills he would have settled this long ago.

The chairman stated that we all labored under the impression based on the statement of the president that we could keep so close track that we would know pretty well what the men were doing; but that if this union at McKeesport mill had been formed between last April and the time the presidents were here we did not have the information.

The president stated that in view of the conditions we will have to settle this strike; it is not that we have to do so if we had taken the definite position, but all conditions considered he believes that this committee can not do else than as suggested by Mr. Reid.

The chairman stated that it has been suggested that Mr. Shaffer knows from time to time that we are not entirely of one opinion with reference to what ought to be done, and he wants to say that he can not believe any member of this committee has ever mentioned the subject outside of this room; and if not, how can Mr. Shaffer know? The president replied that at the presidents' meeting it was pretty well understood that we were not a unit on this question.

JULY 8, 1901.[1]

LABOR.

The president reported no change in the situation.

Mr. Roberts suggested that the committee should receive more information as to the mills which are reported to be nonunion. It is the belief of Mr. Roberts that the representatives in conference should not express an ultimatum without consulting this office.

Mr. Edenborn stated that he believed the reinstatement of those men is one of the worst moves in this controversy. He believes that Mr. Shaffer takes the position that the only basis on which the conference should proceed is that all of the sheet and steel and hoop mills should sign the scale; that it would be foolish to reinstate the men, but that if he claims only the signing for the three mills he would favor agreeing to Mr. Shaffer's position.

Mr. Steele stated that he believed that these men should be put back; that it was a mistake to remove them. Mr. Steele thinks it is not necessary to decide now on anything but these three mills.

After some discussion the following motion was offered by Mr. Steele and duly carried:

"First. That the 12 men discharged should be reinstated if requested.

"Second. If the several representatives of the sheet-steel and hoop and tin-plate companies taking up negotiations with Mr. Shaffer and endeavoring to effect settlement on the basis of conceding to the union the three mills that were in dispute, including McKeesport, Beaver Meadow, and Scottdale, failed to reach prompt settlement on that basis, they should prolong negotiations until an opportunity can be had for further conference with the president of this corporation."

The president reported that Mr. McMurtry had informed him at noon that if the three mills were conceded, especially McKeesport, after we had decided to shut it down, he would lose his superintendent.

The president explained his opinion that the handling of the matter at Wellsville was very bad, but Mr. Smith evidently carried out these old instructions. The chairman asked the opinion of the committee as to the understanding of the substance of instructions. The reply was that it is exactly as Mr. Steele stated. The representatives are not to conclude, but leave an open door, so that the matter can be presented here if necessary.

JULY 11, 1901.

LABOR.

The president reported that Mr. Preston had communicated to him through Mr. Gary to the effect that the representatives had met Mr. Shaffer, he believed, this morning; that Mr. Preston is already in conference with them; that a good deal of talking was going on on the part of the representatives of the association, and that Mr. Preston and his colleagues were allowing them to go ahead and let it drift along in the way that was outlined to Mr. Preston.

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[1] Continuation of morning meeting, and not separately dated.

JULY 12, 1901.

LABOR.

Mr. Steele reported to this meeting that an informal talk over the labor situation had taken place this morning between such of the directors as could be reached at that time, and there were present Messrs. J. P. Morgan, H. H. Rogers, Robert Bacon, Abram Hewitt, Charles Steele, and the president of this company; that during this talk the whole labor situation was again gone over, and it was the opinion of those present that it was necessary to give some definite decision in order that the president might instruct Mr. Preston with reference to what answer he should make to the Amalgamated Association; that it was the unanimous opinion of those present that we should say we were willing to sign the scales in all of our union mills as we had last year as submitted, but that we refuse to negotiate with the association in any particular for the mills known as nonunion mills. Mr. Steele also reported that the members of the finance committee were in favor of this disposition, and had adopted a recommendation to that effect.

After some discussion between members of the executive committee present it was moved by Mr. Reid that this committee does hereby make the same recommendation; all voted in favor thereof except Mr. Roberts, who voted in the negative. On motion duly carried the president of the company was instructed to issue the necessary instructions in the matter.

APRIL 1, 1902.

LORAINE STEEL CO.—DOCK LABORERS.

There is a peculiar condition existing at Loraine. The Loraine Steel Co.'s plant is entirely nonunion. The dock laborers there belong to the Dock Laborers' Union, but have never been recognized. The Loraine Steel Co. has always paid the same wages as paid on all other docks. The question that presents itself this year is somewhat different from prior years, owing to the fact that the dock union could not afford to call out their workmen on the docks, whereas this year all of the other union men employed by other companies belonging to the United States Steel Corporation can be called out if Loraine does not recognize them as the others do. I am somewhat at a loss in the matter. I do not like to stir up the question, nor do I want them acknowledged, because of the effect it may have on the other men at the Loraine plant. Mr. Coolidge stated that he would prefer not to acknowledge and make his fight, but that it might result seriously. The matter is complicated, in view of the fact that we contemplate adding to our works at Loraine. I would be inclined to tell Coolidge to do the best he can under the circumstances, and if necessary recognize them rather than precipitate trouble.

The CHAIRMAN. I think he can settle it this way, and would suggest that he state that he can not sign the scale, but is perfectly willing to go on same as if the scale were signed. Any other rule would be a departure from our rule at the Loraine plant.

Mr. STEELE. I suggest Mr. Coolidge be instructed to do the very best he can, and if necessary to sign.

On motion, duly seconded, it was voted that the last suggestion be adopted.

APPENDIX E.—AFFIDAVITS PRESENTED BY THE AMERICAN FEDERATION OF LABOR REGARDING ACTION OF UNITED STATES STEEL CORPORATION DURING THE TIN-PLATE STRIKE OF 1909.

Numerous affidavits were made by the organizers of the American Federation of Labor and of the Amalgamated Association to the effect that during the month of July and August, 1909, they were forcibly prevented from holding meetings in the town of Vandergrift, Pa., and Morgantown, W. Va. These affidavits were presented in a document entitled "Statement and Evidence in Support of Petition and Charges Presented to the President of the United States against the United States Steel Corporation by American Federation of Labor, Washington, D. C., 1910."[1] The principal affidavits are reproduced below.

EXHIBIT 1.

Several organizers for the Amalgamated Association of Iron, Steel, and Tin Workers went to Vandergrift, Pa., about July 1, 1909, leaving Mr. George Evans, William Hilton, and George Bender there while I returned to Pittsburg in the interest of the organization. I returned to Vandergrift Friday, July 9; in going up on the train I met Mr. A. Jenkins and Forny James, organizers of the United Mine Workers of America, who informed me that they were going to Vandergrift, as they were going to see some of the men working in the mines in that vicinity, inviting me to go with them, as they knew some of the men employed at the mills. We arrived in Vandergrift, Pa., about noon July 9, made inquiries regarding persons working in the mill, and were directed to Vandergrift Heights. We went there at once and found the men were anxious to organize.

Mr. Jones and I remained there about one and a half hours, and the men requested that we return that evening about 6.30 p. m. and they would have a list of names for us. I reported the matter to the other organizers, and it was agreed to meet the men in Vandergrift Heights. Mr. George Bender, William Hilton, George Evans, and I went to Vandergrift Heights as agreed. On arriving there we learned that the men whom we had talked to had been threatened with discharge and the men were uneasy, so we decided to leave until everything was in better condition for the men to talk. We were returning to Vandergrift, Pa., when Labanna Steele and Mr. Dunn, who were watchmen, and a minor bossing job, lead a mob attacking us. I tried to point out to them that we were there for the purpose of discussing the question of organization, when I was struck alongside of the head with a broom handle in the hands of Mr. Steele, Mr. Dunn smashing my glasses at the same time. A number of others assaulted us. One of the men in the mob struck at Mr. Hilton with a knife. We were then taken down through the principal streets of Vandergrift by Mr. Steele and Dunn, and the mob following. We were then placed on a train with a warning never to return. And up to the present time it is unsafe to enter the town, as you are in danger of being attacked at any moment. We have failed to secure a hall or a vacant lot to hold a meeting because the property owners are afraid the American Sheet & Tin Plate Co. will make it so unpleasant that they will be compelled to leave the community.

(Signed) LLEWELLYN LEWIS.

STATE OF PENNSYLVANIA, *County of Allegheny, ss:*

Before me, the subscriber, a notary public of the State and county aforesaid, personally appeared Llewellyn Lewis, the deponent named in the statement on the opposite side of this page, who being duly sworn according to law, doth depose and say that the facts set forth in the foregoing statement are true, to the best of his knowledge and belief.

(Signed) LLEWELLYN LEWIS.

Sworn and subscribed this 29th day of December, A. D. 1909, before me.

[SEAL.] (Signed) EVA A. MILNE,
Notary Public.

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[1] This statement is printed in the Journal of Proceedings of the National Lodge of the Amalgamated Association of Iron, Steel, and Tin Workers, 1910, pp. 8880–8927.

EXHIBIT 2.

STATE OF PENNSYLVANIA, *County of Allegheny, ss:*

Before me, a notary public in and for said county and State, personally appeared Robert Edwards, of Martin's Ferry, State of Ohio, who being duly sworn by me, deposeth and says: That on July 3, 1909, he was engaged as an organizer for the Amalgamated Association of Iron, Steel, and Tin Workers of North America, and was sent by said organization to Vandergrift and Apollo, in the State of Pennsylvania; and that while serving in that capacity on or about July 22, he was engaged in the distribution of circulars among the mill men in the borough of Vandergrift, and while so engaged he was on the afternoon of that day accosted on the streets of Vandergrift by one Jack McIntyre, who was then employed as a boss or foreman in the galvanizing department of the Vandergrift mills of the American Sheet & Tin Plate Co. That McIntyre, with 8 or 10 men, to deponent unknown, asked him what his business was, and when told and given copies of the circulars that deponent was distributing, McIntyre told him that he was not wanted in that locality and he must leave town; that McIntyre and those who were in company with him encircled him and ordered him to go to the depot and leave on the next train; that while on his way to the depot he eluded the crowd and sought refuge in the post office until the train had left the town. When he came out of the post office he was again approached by McIntyre and told that he must leave town and not return, and that if he did return he would be taken out in a box. Deponent further says that he had arranged for a public meeting to be held on a vacant lot rented by him for that purpose in the borough of Apollo on the evening of July 31, 1909; that a day prior to that time Mr. Cochran, from whom the lot had been rented, came to William Edwards, one of the organizers, who had acted as the representative of Robert Edwards, and asked him to surrender the receipt and allow him (Cochran) to return the money paid for it, giving as his reasons that if he permitted the property to be used for a labor meeting that his business interests in the community would be ruined. The request was refused and the meeting held under the protection of John Kennedy, chief of police of the borough of Apollo, after advising deponent to go to the meeting prepared for trouble.

After the adjournment of the meeting, at or about 7.15 o'clock p. m., he, in company with William Edwards, David Watkins, Reese Jones, John Edwards, and four others, returned to the Parks Hotel, where they were registered guests; that at or about 8.30 o'clock p. m. Oscar Lindquist, superintendent of the Vandergrift works of the American Sheet & Tin Plate Co., called at the hotel and asked for an interview with him; that he, together with William Edwards and David Watkins, went to a room with Lindquist, who asked them what their business was. On being told Lindquist said that they were not wanted there and that they would have to leave. Deponent claimed that they were exercising their rights as American citizens as guaranteed to them by law. That Lindquist then replied that his word was the law; that he was the Scottish chief in that valley, and that what he said must go. That Lindquist told Edwards and his companions that he would give them one hour to get out of town, and that if they failed to do so he would get them out if he had to burn the hotel down. That while this interview was taking place a crowd had assembled on the street outside the hotel, upwards of 200 people being present; that the crowd remained about the hotel until about 12 o'clock midnight, when Burgess Steele, of Apollo, came to the hotel and told them that his, the burgess's power was gone, and that he could not control the crowd any longer, and that they could only be appeased by the promise that the organizers would leave town the following morning, and that was the only way by which he could avert bloodshed; that the promise was given the burgess, and that he, the burgess, in company with another man, returned to the hotel on the following morning to see that the organizers would leave on the first train.

Deponent further says that the borough of Apollo is situated a distance of about 2 miles from the borough of Vandergrift; that they are in different counties; that Oscar Lindquist resided then in the borough of Vandergrift; that a large number of the men who composed the crowd that congregated about the Parks Hotel were also residents of the boroughs other than Apollo.

Witness my hand and seal this 29th day of December, A. D. 1909.

ROBERT EDWARDS. [SEAL.]

Sworn to and subscribed before me this 29th day of December, A. D. 1909.

[SEAL.]

EVA A. MILNE,
Notary Public.

My appointment dated April 28, 1909. My commission expires end next session of senate.

EXHIBIT 6.

PROCLAMATION.

After congratulating the people of Vandergrift and the adjoining boroughs on the measure of peace and prosperity which now pervades the community, I know that I voice the sentiment of all good people in saying that we would deplore anything that would mar the peace and harmony which now pervades the entire community, and this is particularly so as regards Vandergrift borough. It is therefore a matter of regret that outside influences seem to be at work, the accomplishment of which would only tend to disturb the peace and order of the borough of Vandergrift. I refer to marches, parades, meetings, and demonstrations by persons, mostly nonresidents, and which could have no other effect than to engender ill feeling among our citizens and neighbors.

As the corporate officer of the borough of Vandergrift, Pa., charged with the maintenance of the peace and order of the borough, I can not tolerate or permit any such conditions to exist.

Now, know ye that I, James H. Chambers, burgess of the borough of Vandergrift, Pa., by and under authority and power in me vested by law, do hereby (until such time as may seem more expedient) forbid the assembling of persons in large crowds upon the streets, alleys, highways, or private properties, and all marches, parades, public meetings, or any other public demonstration within the borough limits, and all persons are commanded to follow their usual avocations in their usual quiet way.

Given under my hand and seal this 31st day of August, 1909.

[SEAL.] JAMES H. CHAMBERS, *Burgess.*

SUPPLEMENT TO EXHIBIT 8.

APOLLO, PA., *November 22, 1909.*

To the officers of the American Federation of Labor:

GENTLEMEN: I feel that I can offer something that will give your honorable body some idea of the condition of things in the mills at Vandergrift. I have been working for the American Sheet & Tin Mills in Vandergrift, Hyde Park, Leechburg, and the old Apollo mill, in the capacity of shearman for 10 years, and they found no fault with my work. When working at Hyde Park, September 9–10, 1909, I worked as shearman, and after paying my help I was in debt 5 cents for the two days.

When the A. F. of L. opened its meetings in Apollo, the men of the mills were forbidden to go to those meetings, but, however, my wife and my sister-in-law went, and because of this me and my brother-in-law were discharged. We were reported by a man that works for the steel company. This man is my neighbor. He and his wife watched the meetings of the federation, and then he would carry the report to the mills.

If there are any notes or figures wanted to back this up I can furnish them.

When I was discharged on September 16, 1909, there was no fault to find, only that I would not promise to keep my family away from the meetings of the Federation of Labor. This I would not do, and so I got my time.

(Signed) D. P. BOYER.

STATE OF PENNSYLVANIA,
County of Armstrong, ss:

Before me, a notary public in and for said county and State, personally appeared D. P. Boyer, who, being duly sworn, says that the foregoing statements are true and correct to the best of his knowledge and belief.

(Signed) D. P. BOYER.

Sworn to and subscribed this 22d day of November, 1909.

[SEAL.] (Signed) MARY W. HENRY, *Notary Public.*

Commission expires January 16, 1913.

APPENDIX F.—CHARACTER AND SEVERITY OF THE WORK IN PRODUCTIVE OCCUPATIONS IN 1895 AND IN 1910.

In order to show clearly just what were the relative conditions attending the work in particular occupations in 1895 and how they compare with the situation at the present time, a careful description of the processes and occupations in each department as they existed in 1895 has been prepared by a superintendent from the records of one of the large steel mills, and is shown herewith. This description, it should be noted, shows not only the duties performed by the men in the various occupations but in a concise way the severity of the work and the conditions under which it was done. This description may be compared either with the general outline of processes in Chapter II of this volume or with the elaborate description of occupations presented in Volume I of this series. In order to bring out the principal points, certain comments as to the relative situation in 1910 have been added in connection with each occupation or group of occupations.

BLAST FURNACES.

In 1895 this plant had two blast furnaces producing 508 tons per day, and employing 194 men. The average output per man per day was therefore 2.6 tons. In 1910 there were 4 furnaces producing 1,904 tons per day and employing 420 men. The average output per man per day was therefore 4.5 tons, or 1.7 times as great as in 1895.

1. General.—The blast furnaces in 1895 were two in number, occupying the same relative location that they do to-day. Instead of the present ore yard, with its equipment, there was a series of elevated tracks and trestles, covered by a building of steel construction, with roof and open sides. All raw material, such as ore, limestone, and coke, received in railway cars, was unloaded from these trestles largely by hand, with the aid of shovels and forks, by a large force of ordinary labor varying in number in different seasons of the year. The stock now being available in this stock house was taken care of by the following:

1910.—Raw materials are now unloaded by car dumper and handled from stock piles to bins by ore bridges and transfer cars. No material is now handled by hand.

2. Barrow Men (14 men per turn, 12-hour turn, day wage):

These men, in 1895, loaded large two-wheel barrows, similar to those in use at the present time, by hand from the various stock piles of ore, limestone, coke, etc., moving them, when loaded, to the scales to be weighed, and then placing them in position for the next workman, which was the cager.

3. Cager (1 man per turn, 12 hours, day wage):

This man took the barrows of stock and placed them on the cage of the vertical hoist, and they were then elevated to the landing stage at the top of the furnace. The cager did not accompany the load, but remained on the lower floor.

4. Top Fillers (2 men per turn, 8-hour turn, day wage):

Their duty was to operate the ascent and descent of the hoist from their position on top of the furnace, take the stock in the barrows from the cage, dump them into the open top of the furnace, and operate the mechanism which lowered the bell, that in turn admitted the charge. This operation permitted the escape of large quantities of gas, which more or less affected the men in this occupation. For the equal distribution of the charge they necessarily would have to distribute the loads regularly around the furnace, and when they had to dump the stock on the lee side, with a high wind prevailing, it was exceedingly dangerous. The occupation was hazardous also because of the slips that occurred in the blast furnaces, at which time the tops were frequently blown off, and these men were without any means of escape, with the result that there were frequent fatalities.

1919: Sections 2 to 4.—Materials are now brought from stock bins by means of electrically operated scale cars, which automatically weigh the materials, and are dumped into furnace by skip hoist, which automatically distributes the materials. No hand labor is connected with the operation and no men are required at top of furnace. Exposure to gas is practically eliminated except in case of repairs or inspection.

These completed the occupations on the back of the furnace. Taking up the front side, the following conditions existed:

5. Blower (1 man per turn, 12 hours, salary):

His duties were those of foreman and leading man in charge of the furnace, supervising the routine work. He did not perform any manual labor except in cases of emergency.

6. Keeper (1 man per turn, 12 hours, day wage):

This man had charge of casting the metal, made the runner to the sand bed, and stopped the tap hole with the aid of hand tools of various kinds for this purpose. This was frequently a very prolonged, hot, and laborious job during tapping operations, the work being nearly all manual labor.

7. Hot-Blast Man (1 man per turn, 12 hours, day wage):

This man looked after the stoves and performed duties similar to those of the present time, under the instructions and direction of the blower. His duties then, as now, were cleaning the stove wells, keeping the peep holes and tuyeres clean, and dumping the flue dust from the dust catcher.

8. Keepers' Helpers (4 men per turn, 8 hours, day wage):

Their duties were to make up the sand pig bed, keep the iron trough clean, make up what is known as the skimmer, and help the keeper stop or tamp the tapping hole. They also helped to change tuyeres and with any other jobs that emergencies created about the furnaces.

9. Iron Carriers (10 men per turn, 12 hours, day wage):

These men helped to "run" the iron, which was to watch it in its flow through the various channels in the sand beds. After the cast, they quenched it, broke it up, ranked it and loaded it on cars for shipment to the various departments, chiefly the Bessemer department; an exceedingly hard and laborious job. In addition to the heat they were working constantly in a cloud of hot moist vapor which was decidedly debilitating.

10. Sanders-Up (2 men per turn, 12 hours, day wage):

They helped to keep up the iron runner to the end of the cast house and to throw sand on the hot iron, to keep the heat down while the carriers were at work on the bed.

11. Scrappers (2 men per turn, 12 hours, day wage):

They helped the iron carriers break the iron, and cleaned the scrap out of the runners and the pig bed generally.

1919: Sections 8 to 11.—All iron is now run into ladles and carried directly to Bessemer department or cast in pig machine. This eliminates work of iron breakers, sanders, and scrappers, and relieves work of keepers and helpers. Runners are now made of cast iron lined with clay and tap hole is stopped by means of mud gun.

12. Monkey Boss (1 man per turn, 12 hours, day wage):

This man tapped the cinder from the furnace between casting periods, cleaned the cinder left in the cast house after casting, and took care of this cinder on the bank. There being no granulating pits as at present, the cinder flowed out through roughly channeled beds to the bank.

13. Cinder-Bank Men (7 men per turn, 12 hours, day wage):

It was their duty to quench the cinder, break it up with the aid of bars and sledges, and load it on cars by hand with a fork. This was a very hot and laborious job, the men being constantly at work in a cloud of steam and exposed to the weather conditions in the open at all times of the year.

1910: Sections 12 and 13.—Slag is now run into ladles and dumped by means of motors attached to ladle cars. The work is still extremely hard, but it is a great improvement over that previously performed by cinder-bank men. Granulating pits are also used, which eliminate all hot and laborious work connected with the disposal of cinder.

BESSEMER DEPARTMENT.

In 1895 the converters with a normal force of 113 men produced an average of 629 tons per day, or 5.57 tons per man. In 1910 with a normal force of 196 men the converters averaged 2,315 tons per day or 11.8 tons per man, or about twice as much as in 1895.

1. Foreman (1, salary):

His duties were as follows:

(*a*) Had charge of the cupolas and melting of the iron, which was all in the form of cold pig iron as it came from the blast furnaces; (*b*) in charge of the converters in which the melted iron was blown and the pouring of the converted iron into molds, and (*c*) disposition of the same either to the blooming mill or ingot stock pile. Duties supervisory, with no manual labor.

2. Metal Wheelers (6 men per turn, 12 hours, tonnage); and Loaders (4 men per turn, 12 hours, tonnage):

The duty of the metal wheeler was to use a special heavy barrow with a single wheel, on which he piled from 1,000 to 1,200 pounds of pig iron and wheeled it a distance of about 100 feet from the point of loading to the scales at the elevator. This work was performed out in the open and he was exposed to all kinds of weather. It was an extremely laborious job and difficult for the reason that the load had to be kept in balance due to the barrow having but a single wheel. The loaders referred to in connection with these metal wheelers merely assisted in loading the stock on the barrow. After weighing, the wheeler moved the barrow and load about 15 feet to the platform of the vertical hoist.

3. Coke Men (2 men per turn, 12 hours, tonnage):

These men used large single-wheel barrows which they pushed under the chute of the coke bin and allowed the coke to run into the barrow. At times when the coke contained too much dust, it was run on the ground and these men then forked it from the ground into the barrows. They wheeled the barrows to the scales and after weighing placed them on the hoist. Neither the metal wheelers nor the coke men accompanied the barrow of stock on the hoist.

4. Hoist Men (2 men per turn, 12 hours, day wage):

These men operated the hoist from their position on the upper floor, controlling the engine which drove the hoist drums through the medium of governing ropes and counterpoises.

1910: Sections 2 to 4.—Material for the cupolas is still handled by hand but there is very much less of it necessary, because of the use of direct metal and improved two-wheel cars making the work of handling it very much easier than with the single-wheeled barrows described above.

5. Top Fillers (2 men per turn, 12 hours, tonnage):

These men took the barrows containing the different stock from the hoist, wheeled them about 15 feet, and dumped the contents into the top of the cupola, which was open entirely on top. The escaping flame and gas came out into this part of the building, there being no hood or stack provided for carrying them away. The idea of this open top was to permit these fillers to dump their stock at points all around the edge, making equal distribution of the burden in the cupola. The occupation was not only laborious but decidedly unpleasant for the reason that when a man would be dumping the contents of his barrow on the lee side, the wind would drive the escaping gas and flame right on him. As the burden had to be equially distributed he was subject more or less to this condition.

1910: Section 5.—In some plants cupolas are still charged by hand, but in many of them charging machines are now used which greatly increase the efficiency and improve the worst features of the work. The elimination of the open top through the improved construction of the cupolas has done away with a great part of the gas and smoke described above as characteristic of this department. It is, nevertheless, very hard work under even the best conditions. There has been no change in the essential conditions for the other men in the cupola crew except that a smaller number of them are required.

6. CUPOLA FOREMAN (1 per 12-hour turn, tonnage):

His duties consisted of looking after the melting of the iron in all the cupolas and tapping from one of them. A very hot job, constantly exposed to a high temperature without any artificial means of inducing air currents and no protection in the way of water shields to check the radiated heat. His tools were a long steel bar, known as a tapping bar, and a bott-stick used for closing the hole after tapping.

7. IRON TAPPER (1 per 12-hour turn, tonnage):

His duties were the same as those of the cupola foreman, with the exception of overseeing, and subject to all heat conditions surrounding him.

8. CINDER TAPPER (1 per 12-hour turn, tonnage):

His duties were to tap cinder from all cupolas, using for this purpose a steel bar, and a bott-stick for closing up the hole. Also at times he used a steel chisel bar and sledge to open a chilled hole and to remove metal from tuyeres. He was subjected to the same heat conditions as the cupola foreman and iron tapper. The molten metal was conveyed through a trough to a central point over a ladle on the car into which it flowed. This car was on a track level with the nose of the converter and was moved by means of a chain winding on a drum operated by a steam engine; all of which outfit was the source of much trouble and attention to the foregoing workmen.

9. LADLE CAR ENGINEER (1 per 12-hour turn, day wage):

He operated the engine that moved the car above described and his working position was on the tapping floor, where it was very hot. He also controlled the tilting of the iron ladle into the vessels, a chain having previously been hooked to the ladle.

10. MANGANESE MAN (1 per 12-hour turn, tonnage):

His duty, in addition to attending to the hot metal ladle car, was to shovel the charge of crushed ferromanganese into the bath as it was poured from the converter. His occupation exposed him to intense heat radiating from the vessels and ladles and he was in a zone completely surrounded by these intensified conditions when working, especially so when rabbling the heat, which was done by thrusting a long wooden pole into the mass, causing a violent reaction and splashing out portions of molten metal on his person.

1910: Section 10.—The necessity for rabbling as described above has been practically eliminated. The work of the manganese man, however, is still extremely hard, though it has been relieved of this particularly dangerous and exhausting feature.

11. VESSEL FOREMAN AND HELPER (1 each per 12-hour turn, tonnage):

Their duties were to change the bottoms when necessary during the turn and to make frequent patching of the lining of the vessel with refractory material, using a long iron pole, known as a paddle or peel, on which was placed a mass of plastic material and introduced into the vessel and the same plastered on the desired spot. This exposed them to intense heat for the time being, no means being provided for shield-ing them from it. When replacing a bottom, which is attached to the vessel by means of bolts, hangers, and cotter pins, they used large hand hammers and sledges to remove and replace the same. These men, in addition to the routine duties during the operation of the mill, also worked during the idle period at the week end in the renovating of the lining of the vessels with the proper materials.

1910: Section 11.—There is no essential change in the work of the vesselmen except that patching is required much less frequently and means are provided which to some extent shield the men while they are performing the work. It is extremely hard work at the present time, however, and must be done at top speed and under very intense heat conditions, as a very few minutes' delay in changing the vessel bottoms is of the greatest importance, not only in the actual loss of time but owing to the fact that the vessels cool rapidly and a long delay in replacing a bottom makes it necessary to heat the vessel by artificial means and perhaps even then to lose the first heat that is blown.

12. BLOWER (1 per 12-hour turn, salary):

His duties constituted him the responsible man of the department. His active work consisted in the skillful manipulation of a series of levers controlling the converters during the process of blowing. At this time the position of this man when working was more or less hazardous. The platform spanned the casting floor and the ingot cars passed directly in front of him, and when the molds were not capped right the caps would blow off and the contents of the mold splutter out and up on him and the other men working on this raised platform. In addition to this the temperature was always high, due to the hot molds and steel constantly passing before them, and this was the cause of much discomfort.

1910: Section 12.—In the particular mill described the position of the blower has been entirely changed so that he is now on an elevated platform situated entirely away from the heat of the pit and open on all sides to get whatever breeze may be blowing. There are still two or three Bessemer plants in which platforms similar in location to that described above are in use, and the conditions in these plants are essentially the same as given in the description.

13. FIRST AND SECOND REGULATORS (1 each per 12-hour turn, tonnage):

These men worked on the same platform with the blower, and their environments were practically the same as his. Their duties were to operate the many levers controlling the vessels, ladles, cranes, etc.

14. STEEL POURER (1 per 12-hour turn, tonnage):

His duties were to operate the stopper mechanism of the steel ladle when pouring into the molds. When working he was close to his work and exposed to intense heat as well as in danger of being burned by splashing metal. Assisting this man was a capper.

15. CAPPER (1 per 12-hour turn, tonnage):

The capper's duties were to help the pourer when necessary and regularly to place the caps on top of the molds when filled, locking them with a crossbar inserted under proper lugs and wedged between these lugs and the cap, using a hammer as his only tool.

16. TEST MAN (1 per 12-hour turn, day wage):

This man, with the aid of a small hand ladle, caught a portion of the metal flowing from ladle to mold, to be sent to laboratory for the necessary chemical determinations. He also removed the caps from the top of the molds after ingot chilled.

1910: Sections 14 to 16.—The conditions for the steel pourer, capper, and test man are practically unchanged in this particular establishment, as car casting had been introduced previous to 1895 in this particular mill.

17. VESSEL CINDER MEN (2 per 12-hour turn, tonnage):

After the metal was poured from vessel to steel ladle the slag remaining was dumped on the floor by the complete upending of the vessel, and it was the duty of these men to quench the slag, break it up, and with the aid of forks load it on metal wheelbarrows and wheel it to a place provided for the purpose, a distance of about 75 feet. This was an exceedingly dangerous occupation on account of exposure to the hot metal which was being poured at platforms above and liable to be spilled. It was intensely hot in the building at this point and they were also subjected to the conditions of the weather when disposing of cinder.

1910: Section 17.—This work has been made much lighter by the use of overhead cranes and special slag boxes for removing the cinder after it has been cooled. The workmen are otherwise still exposed to essentially the same conditions as are described above.

18. Stopper Setter (1 per 12-hour turn, tonnage):

This man set the stopper in the ladle before filling and removed the worn-out stoppers after every three or four heats.

19. Stopper Carrier (1 per 12-hour turn, tonnage):

He was assistant to the stopper setter, taking the worn-out stoppers to the stopper maker and bringing new stoppers from the drying oven.

20. Ladle Liner (1 per 12-hour turn, tonnage):

He renewed the linings of the ladles with the proper refractory material.

21. Bottom Maker and Helper (1 each per 12-hour turn, tonnage):

Their duty was to build up the bottom of refractory material, all ground and moistened and in plastic state, which was packed in with the aid of rammers similar to those used by molders, and with shovels, hammers, and bars. The work was laborious, but not uncomfortable.

22. Bottom Oven Fireman (1 per 12-hour turn, day wage):

This man fired the oven for drying the above-mentioned bottoms. Coke was used as fuel, which was fired by hand with the use of a fork.

1910: Section 22.—Gas is used almost uniformly for heating the drying oven.

23. Shake-Up (1 per 12-hour turn, day wage):

His duty consisted of using a pinch bar under the bottom of mold on which was cast a boss to engage the point of bar, and by swaying up and down to loosen mold and ingot from the "stool" or top of car. A pipe was slipped over this bar to increase its length and the leverage as well. This was exceedingly laborious and hot work. The mold cars containing the ingots were hauled by means of a dinkey engine to the "stripper," which was located in one end of the soaking-pit building. Here the stripping mechanism was operated by a stripper man and helper.

1910: Section 23.—This work is eliminated altogether by the use of a more efficient ingot stripper than was in operation in this plant in 1895. An electrically-operated plunger, which can be shoved down through the top of the ingot mold, is now used to remove any ingots which do not come out readily when the mold is lifted.

24. Stripper Man and Helper (1 each per 12-hour turn, tonnage):

The stripper man worked on a "pulpit" or raised platform about 7 feet above the ground level, and operated the various levers governing the action of the machinery, exposed to the heat rising from the stripped ingots. His helper worked on the ground level and operated the chain engaging the arms that caught the lugs on the mold. This was a very dangerous and uncomfortable occupation.

1910: Section 24. The stripper man is now situated in a platform elevated very much higher above the car tracks and consequently less directly exposed to the heat, although it is still a very hot position. The arms which catch the lugs on the mold are now operated entirely by machinery and no men are required on the ground, except a few laborers for cleaning up.

PLATE MILLS.

In 1895 the plate mills had a normal force of 545 men and an average production per day of 627 tons, or 1.15 tons per man.

In 1910 the plate mills had a normal force of 323 men and an average production per day of 1,924 tons, or 5.96 tons per man. The output per man per day in this department in 1910 was 5.2 times as great as in 1895.

1. General.—Stock arrived in railroad cars at the plate mills, a distance of a half mile from the steel works, and consisted of billets and slabs in sections from 4 inches by 4 inches to 6 inches by 23 inches, and of such various lengths as the weight required. It was cold, and in the smaller sizes was unloaded by hand at stock piles in proximity to the mill, or directly at the point of consumption by a crew of laboring men at some of the mills, and at others by the regular stockers of that mill.

2. Unloading and Stocking.—The cars of steel were placed under an umbrella-shaped building, with a jib crane in center having a radius of 28 feet. As the stock for this mill was always in large section, it was assembled in the cars in piles of 3 to 5 tons and this load lifted out of car by the crane. This crane was driven by a vertical engine attached to the mast and connected with the winding drum. When the load was raised to the right height, the laborers caught hold of a rope attached to the outer end of jib and swung the load around to the point desired and lowered it by means of a friction brake on the fly wheel. Sometimes the face of this wheel would be wet from steam leaks about the engine, and, as a consequence, the brake was of little benefit, and the load simply dropped, all hands keeping from under it.

1910: Sections 1 and 2.—All slabs are now unloaded by cranes, and hand labor of the kind described above is completely eliminated.

3. Pilers (1 per furnace, the number varying from 3 to 6, day wage):

Their duties began about 4 a. m. on day turn, or one hour before the time for the starting of the mills. It was the custom for the off-going turn to leave a heat in the furnace for the on-coming turn, therefore the pilers came in ahead to have the heats up and ready for the furnaces as they are emptied, which would be in rotation, from one to two hours after starting. These men worked as a team. The buggies for handling the slabs weighed 1,600 to 2,000 pounds empty, and with a load of two tons on were quite heavy. The buggies were four-wheeled, the front and back trucks being pivoted and each controlled by a separate handle. The wheels cut under the body in a complete arc, and often when both handles were cut at right angles at the same time, over the buggy would go and spill the load on the floor, sometimes catching one of the crew and injuring him. These buggies were drawn before the furnace, standing tandem to it, the slabs on them being parallel to it, and on their edge. When ready to charge, the piler assisted by throwing the slab over to fall on the flat side.

1910: Section 3.—The slabs are now brought to the furnaces on small cars which are drawn by narrow-gauge locomotives.

4. Charger (1 per 12-hour turn, day wage):

This man served all furnaces and handled the stirrup under the peel as described later.

5. Heaters (1 per furnace, 12-hour turn, tonnage):

He was the skilled workman on the furnace and responsible for the proper treatment of the material. The furnace he had charge of in this mill was one of a group of a type known as the Siemens's regenerative furnace, rectangular in shape, about 28 feet in length and 9 feet in depth, having a hearth about 7 feet deep and 14 feet long between the end flues coming up from the regenerative chambers beneath. This type of furnace used artificial gas for fuel, conducted through underground flues and admitted to the furnaces through a regulating valve in a pit beneath the floor in front of the furnace. This floor, which consisted of beams across the pit on which were iron plates, constituted the working floor or "standing" for the crew. This floor would become so hot from the heat in the valve pit beneath that it was frequently necessary to cool it off with water. In summer it was a decidedly uncomfortable place on account of the heat, and in winter on account of the cold. The duties of the heater included the regulation of air and gas valves controlling combustion and the frequently reversing of the flow of these from one end of the furnace to the other. With the furnace empty, he would proceed as follows: The buggy of stock was placed on the "standing" before furnace. A large peel, 10 feet to 14 feet long, and weighing 150 to 300 pounds, was brought to the furnace from a cooling bosh at side of furnace by the heater who carried one end while his helpers caught up the other end on a crossbar. The end of this peel upon which the slabs were laid was about 6 inches broad and tapered in thickness from a thin edge to about 1½ or 2 inches, while at the other end was a large looped handle about 18 inches wide by which the peel was managed. Suspended from a rail overhead hung a trolley wheel, and on this was a chain to which was attached an open side stirrup of ample size. The heater and helpers hung the peel on this stirrup, and when hung it would be about one-half inch above the level of the buggy containing slabs. This stirrup being swiveled, permitted complete radial movement, and was swung alongside of a slab on buggy. The charger or piler tipped the slab over flat onto the peel; the heater and helper weighed down on the long end and balanced the same, at the same time turning a quarter arc with the piece ready to enter furnace door. They then pushed it in as far as the stirrup hanger would permit. The heater and helper then lifted up their end of peel, its nose touching the furnace bottom; the charger drew back the hanging stirrup, while another helper would place a small roller, made of a short piece of pipe about 2 inches in diameter, on an iron rod bent at right angles. All hands would then give a push, and the piece would land on the spot selected on the hearth. Raising the peel, the roller was released and drawn partly back, then all hands gave a pull, and the peel was freed from under the slab, brought out to furnace door, hooked on stirrup, and swung around into position for another piece. This operation was repeated as many times as there were pieces to charge—anywhere from 4 to 30, according to size and weight—consuming in all about 10 minutes time. The heat charged, the crew could go and sit down for as long as it took to heat the charge—anywhere from 30 to 60 minutes—when the next procedure would be the drawing of the heat. In the meantime the only work any of the crew would do would be to reverse the valves.

6. HEATERS' HELPERS (2 per 12-hour turn, tonnage):

Duties, to assist heater in all work, and in general they did as much of it as he, minus the responsibility. The charge having been brought to the proper temperature for working, the procedure was as follows: Furnaces had to keep turn and no drawing of material out of turn was allowed without the consent of the other heaters. The heater or helper raised door of the furnace, which was hung from a lever overhead balanced with counterweight, and the door being in balance remained in position. The heater used a heavy bar about 1½ inches square, 10 feet to 14 feet long, rounded at working end and known as a paddle, weighing 75 to 125 pounds. He put this under the end of the steel slab in the furnace and raised up, while the second helper lifted up a pair of tongs weighing about 150 pounds, opened the jaws, and pushed it onto the end of slab. When gripped, he hooked a chain on the small chain of the reins; this chain was passed over a pulley stand, on back of "standing," and down over a series of pulleys to a hydraulic cylinder, operated by a boy. With this arrangement the hot piece was dragged out of the furnace onto a buggy waiting to receive it for transfer to roll train.

This completes the initial stages of the work, but the conditions under which it was performed can not be adequately described. The work was of the most laborious character, hot and uncomfortable in summer and equally disagreeable in winter. Although the buildings were temporarily boarded up for the winter season, this served merely to break drafts; consequently the temperature often exceeded out-door conditions.

The renewing of the furnace bottom was done frequently during the turn, always after the heat was drawn. The helpers threw shovelfuls of sand, procured at a near-by box, into the furnace, walking close up to the door in doing so. The heater smoothed it over the furnace bottom with a long iron tool known as a "bottom hook"—a square bar 12 to 14 feet long bent on the end at right angles for a length of 12 inches, with a loop handle at the working end sufficiently large to grasp with both hands, working in a backward and forward motion and sideways by heeling against the jambs of the furnace; this operation often took 10 minutes, during which time the workmen were exposed to the heat of the furnace. The furnaces were equipped with a makeshift of a water shield, consisting of a plate with gutter attached to bottom edge, upon which was sprayed a stream of water. The jets of water were widely separated, consequently the entire surface of the shield was not wet. It acted somewhat as a deflector in turning the heat upwards, and that was all.

1910: Sections 4 to 6.—All the work of charging and drawing the slabs is now done by one man operating an electrically-driven charging machine. The work of the heaters and helpers in renewing the bottom of the furnace, however, remains practically as hard as at the time described above. All doors in this plant are now effectively water cooled.

7. DRAG-OUT BOY (1, 12 hours, day wage):

He operated a hydraulic piston on the end of which was a pulley, around which a chain was run and fastened to an anchorage in the wall of the pit. This chain passed up and over a series of pulleys in front of the respective furnace, and was used to pull piles out of furnace onto buggy, as before described.

8. BUGGY RUNNERS (3 per 12-hour turn, piecework or per heat):

The work of these men was of dual character. First to use a buggy with two wheels and small flat top on which piece was placed or dragged from furnace; they stood tandem to furnace door, one man balancing the buggy and the other holding a scotch block behind the wheels. The heater's helper released the tongs and man at buggy handle cut quarter way round and started down the floor runway toward the roll train, the second man joining on the way and helping to push it. Thus they conveyed slabs to the "foreplate" of the roll train and reaching there they banged the buggy against it, the jar shooting the piece into the rolls. Buggy was then moved to one side and the operation repeated when another piece was ready. As two of these men were engaged at this work, the third man was occupied in handling the "table" buggy in front of the rolls, which was nothing more than a two-wheeled buggy about 30 inches high, with a top 4 feet square and a handle about 12 feet from center over axle. On this was received the piece, which, with every pass through the rolls, was being reduced in thickness and elongated. This workman's position exposed him to the heat, as well as to the frequent flashes of hot cinder and scale, and he was often painfully burned. These three men "sawed off," taking turn-about on the running buggy and table buggy. There was no harder or meaner job than this, and it was a constant annoyance to procure permanent men. At times when the pieces were extra heavy additional help would be given, that is, when the piece exceeded 1,400 pounds in weight. Under this weight the regular crew of three performed the work.

1910: Section 8.—The slabs after being drawn from the furnace by the charging machine are deposited on a roller conveyer which carries them to the plate mill without any manual labor. The operation of the conveyer is controlled by one man located on a platform not far from the rolls, but exposed to no unusual heat conditions.

9. ROLLER (1 per 12-hour turn, day wage):

He was the forehand or leading man on the roll train, personally responsible for the proper treatment of the material, and all the other men were subordinate to him. He had power to employ and dismiss members of the crew subject to the approval of the superintendent. In addition to directing the work he formed one of the crew on the finishing stand of rolls, dividing the labors with an assistant known as a screw man.

10. **Roughers** (2 per 12-hour turn, piecework by the heat):

They were known at first and second roughers. As previously stated, the buggy runners having delivered their piece on the foreplate of the roughing train, it now became the duty of this man to handle this piece. This roughing train consisted of two rolls rotating in the same direction, the top roll being balanced on "steel yards" with counterweights in the pit which kept it always up against the screws. On the back side of this train was a suspended cage resting level with the bottom roll on which the piece was delivered by the rolls. By means of a hydraulic cylinder it was raised with the aid of chain over a series of pulleys on an overhead framework to the level of the top roll. Being suspended in a slightly inclined position, the piece would by gravity fall back over the top roll and drop on the foreplate. The rougher made use of a tool known as a hook, and similar to the pike, to push against this piece so that it would drop centrally on the foreplate, or "swivel" the piece while it was coming over the top of the roll, thereby causing it to fall on its broad side, or on the corner. Entering the rolls in this position in turn would have a spreading action and draw the metal in the direction of its entrance, spreading the piece to the width desired by a repetition of passes. These men were up against the piece constantly and in addition to the intense heat were exposed to the flashes from the rolls. As a protection to their person they wore a large leather apron reaching from under their chin to below the knees, and their face was protected by a wire gauze mask. It was a very laborious occupation in addition to the dangerous and uncomfortable conditions. In the summer season a third man was put on as a spell hand. The company paid part of this man's wages, or allowed these men a portion of his wages, they making up the balance of his pay. Usually this third man was put on about the 1st of May and taken off about the 1st of September.

11. **Catchers** (2 per 12-hour turn, day wage):

They were known as first and second catchers. Their position was on the back side of the aforementioned roll train at the rear of the lifting cage. As the operator raised the cage to the level of the roll top, these men, with the aid of a tool known as a hook, aided in pushing the piece over the roll for the roughers to receive. Their position was neither as hot nor as dangerous as that of the men on the front side of the train, nor was it as laborious. No spell hand was allowed in hot weather.

1910: Sections 10 and 11.—The plate is now handled entirely on an automatically operated roll table and no manual labor is necessary, with the exception of two hookers, one on each side of the stand of rolls, who guide the plate and turn it around whenever necessary. Their position, however, is very hot, and as the plate is very large the work is still very laborious.

12. **Spanner Man** (1 per 12-hour turn, tonnage):

He occupied a position on the raised platform spanning the pit at the end of the roll train. His business was to operate the spanning gear which engaged the crown wheels of the housing screws by which the distance (span) between the rolls was adjusted. On the end of this shaft was a large spoke wheel from 6 to 8 feet in diameter. By catching this wheel by the outer rim and throwing his weight on it, he brought the screws into action, which in turn raised or lowered the top roll. As the piece would receive from 8 to 12 passes in this train and the movements were frequently from 1½ inches to one-fourth inch at a time, it required a great deal of activity on the part of the workman. His position exposed him to the ascending heat from the hot plates as well as to the heat of the train itself. If the roll was not in easy balance it was extremely hard work. In summer time this man took a helper on with him whom he paid out of his own wages, but during the cooler periods of the year he did the work alone.

1910: Section 12.—The operation of the rolls and the regulation of the distance between the rolls is controlled entirely by levers from a platform situated 20 or more feet from the stand of rolls. Essentially the same comments apply to the other occupations connected with the rolling crew.

13. **Hydraulic Operator** (1 per 12-hour turn, day wage):

He operated the cage before described. He was not exposed to any extreme conditions of heat, his position being on the floor level to one side of the train. The piece being partly broken down in section on this train was then transferred to the finishing train which stood parallel to it, and which consisted of a mill of three-high rolls with inclining tilting tables on both sides. In its lowest position the slope was toward the bottom of the middle roll. On the front side of this train the partly finished piece was delivered by the transfer buggy men on the table in front of the rolls.

14. **Table men** (4 per 12-hour turn, 2 on front side and 2 on back); tonnage:

They squared the piece on the table and, by pushing it forward, allowed the rolls to bite it, drawing it in, reducing it in section, and delivering it on a table at the back side. The tables were then elevated to the level of the top of the middle roll and the two men on the back side pushed the piece into the mill, the operation being continued until the piece was reduced to the thickness desired. The roller and his assistant between passes manipulated the screws to secure the proper amount of reduction. These tables merely had dead sheaves in them and were frequently out of order, which meant the use of main strength to move the piece. The workmen, of course, were right up against the piece and were subjected to the heat radiating from it.

15. **Screw Man** (1 per 12-hour turn, day wage):

He assisted the roller in the operation of the screws in the finishing train from a platform spanning the roll pit at the end of the train. This was not as laborious a job as that of the spanner man previously mentioned, but exposed him to the rising heat from the hot pieces.

16. **Hydraulic Operator** (1 per 12-hour turn, day wage):

He controlled the lifting mechanism of the tables and was not exposed to any unusual heat. He incidentally marked with a chalk stick on the hot plates the number of the furnace from which it came for the purpose of identification in making up the weight for the heater operating that particular furnace.

17. **Drag-Out** (1 per 12-hour turn, day wage):

His duties were to drive the mule that dragged out the hot plates from the mill to the ground floor space, distant about 100 feet from the train, by means of a pair of lazy tongs attached by a chain to the harness of the mule. When the piece had received its finishing pass he merely grabbed the end of the plate and the mule did the rest, he guiding it to any vacant spots on the floor.

The plates were allowed to remain on the floor until black hot, when they were looked over by the inspector.

1910: Section 17.—The plates are now carried away from the roll train by roller conveyers operated from a distance by levers and all manual labor connected with this work has been eliminated.

18. **Inspector** (1 per 12-hour turn, salary per week):

He inspected for flaws, serious defects, and suitability of plate for order intended. This did not require any manual labor at all and there was no exposure for any length of time to unusual heat.

19. **Marker and Marker's Helper** (1 each, day wage):

Their duties were to mark the dimension lines with the aid of a template board, which was about 18 inches wide and 22 feet long, shod with metal strips on the underside. They laid this board on top of the hot plate and walked on top of it drawing a chalk mark along the edge of the template; then shifted the template and marked the other side. They then squared the ends with the aid of a large square graduated in inches and fractions of an inch. This was very disagreeable work, as they had to stoop constantly and were exposed to the rising heat from the hot plates, and as the ground was kept wet for the purpose of keeping down the dust, they were all the time working in a moist vapor.

1910: Section 19.—As the plates are now conveyed on a roll table elevated some 3 or 4 feet above the floor level, it is only necessary for the markers to stand alongside the plates in doing their work.

20. **Buggy Men** (5 per 12-hour turn, a certain number of heats constituting a turn, day wage):

These men worked as a team. One of the number took the handle of the buggy, the other four lifting the plates on and off the buggy. Language can hardly describe this buggy. It was two-wheeled, on a single axle; wheels about 18 inches in diameter. On this axle was a skeleton framework about 18 inches in width and about 12 feet long rigidly attached to the axle and a little above the top of the wheels, all in balance. The forward ends of the bars of this frame were drawn to a taper, while on the back end was attached a single T-handle extension, on which was welded a vertical lug which acted as a guard. The workmen would pull this buggy out on the ground; the four lifters would then divide themselves equally at one end of the plate, which was usually about 20 to 22 feet long, and with the aid of forks, which were bars of steel about 1 inch round and 3 feet long with a flattened split head, hold it in a raised position while the man with the buggy would push it as far under the sheet as he could. The lifters would then move their position back along the plate and take another lift while the man with the buggy would push it all the way under the plate, the guard before mentioned serving to prevent the plate from running up on his hands and injuring him. The buggy empty weighed 600 to 800 pounds and the plate from 300 to 2,000 pounds, normally 1,400 pounds and under. The plate now being in balance on the buggy, the lifters engaged the side of the plate with their forks and while lifting on it pushed forward, the man on the handle of the buggy merely guiding it as it moved over the ground to the scales, where it was weighed by the weighmaster who recorded on his books the furnace to which it was to be credited and the roll crew that had worked it.

1910: Section 20.—This work is entirely eliminated by the use of the roller conveyor described above. This applies also to the remainder of the buggy men's duties.

21. **Weighmaster** (1 per 12-hour turn, day wage):

His duties were entirely clerical; no manual labor. He had a comfortable little cabin to sit in.

The buggy men now moved the sheet to the table in front of the shears and reversed the operation of lifting the sheet onto the buggy by lifting the end of the plate onto the casters in front of the shears, leaving it suspended while the buggy men withdrew the buggy. This was the nearest job we had to the mule's job. Frequently, when a plate was raised from the floor, in addition to the strain a cloud of vapor would rise from the wet ground and envelop the men. This was especially unpleasant in winter, there being no protection on the sides of the building, merely a shed over it.

22. **Shearman** (1 per 12-hour turn, day wage):

A leading and responsible man in this department. He was held accountable for the correct shearing of the material to dimensions and a check, in a way, on the marker, having an adjustable hand gauge always at his side to check on the lines laid out by the marker as being the given dimensions. He worked at one end of the table and guided the plate in the operation of the shear to the line, and had a leader and 5 helpers.

23. **Leader** (1 per 12-hour turn, by the day, a certain number of heats for a day) and **Helpers** (5 per 12-hour turn, by the day, the same number of heats for a day):

The shearman, leader, and helpers worked as a team. The shears were of what is known as the guillotine type, with a blade 8 feet long. The plate being on the casters in front of the shear, the shearman at one end of the shear and the leader at the other end, the procedure was to put the plate into the shear endways and cut off the front end to the line marked. The helpers then caught the plate along its sides, one of whom attached a pair of lazy tongs hanging from a trolley overhead. One of the laborers swinging on these tongs balanced the center of the plate while the other four held the end and swung it around, bringing it parallel with the shear blade. The leader took hold of the front end and guided it to the mark, the shearman and helpers steadying the plate on the foreplate of the shear, and when it was in line the signal was given to one of the helpers who operated the shear. The crew pushed the plate forward and repeated the operation, three cuts usually being necessary to trim one side of a plate. This side strip traveled with the plate until the final cut was made when it dropped off. The plate was then quartered around, the end trimmed off, and the other side trimmed off as before described. It was then passed over a roller table to the scales where it was weighed and recorded by the weighmaster.

1910: Section 23.—This work has been greatly lightened by the introduction of various minor features, but it still remains very heavy and exhausting labor.

24. Scrap Cutter (1 per 12-hour turn, day wage):

He took the pieces sheared from the side of the plate and cut them into convenient lengths for handling. The work of the entire shearman's crew was laborious and uncomfortable, although they had the benefit of more air than the rest of the mill hands because of the building being open. In winter they got all of the freezing weather with no heat whatever.

1910: Section 24.—The scrap is now handled almost entirely by cranes and the long pieces sheared from the edges are rolled up in convenient shape by a special machine constructed for the purpose. The building is now inclosed in winter and heated if necessary.

25. Scrap Wheelers (2 per 12-hour turn, day wage):

They disposed of the scrap that was cut up into small pieces, wheeling it in barrows away from the shear and loading it on cars about 100 yards distant.

The buildings used in 1895 were of a rambling character, roofs were low and their shape irregular, and largely open sided, making them very uncomfortable in winter because of the drafts and extremely uncomfortable in summer when they acted merely as hoods holding the heat in. No method of ventilation was provided. When necessary to change rolls it was the duty of the roller and a portion of his crew to replace the worn-out rolls once a week, usually on Sunday morning. The roller had about four helpers and they received a fixed amount for this regular roll changing. There was also a midweek change of a single roll, instead of the set of three, and this same crew of men received a smaller amount each for this work. The change was accomplished with the aid of a hydraulic lifting crane, pivoted, the jib travel of which was not mechanically operated. It usually required a half day's time to make the change of a full set, and an hour or an hour and a half for the change of a single roll in the midweek.

1910: Section 25.—The mills described here are housed in buildings of an exceptionally good type with steel frame construction throughout and brick curtain walls. During the summer the building can be thrown almost entirely open so as to get the advantage of all possible ventilation, while in winter the workmen are sufficiently shielded from the outside inclemency with the exception perhaps of one or two isolated occupations.

TUBE WORKS.

Lap weld mill.

General.—The material commonly known as skelp having been made and loaded on the trucks at the rolling mills for delivery to the pipe mills may be considered as having now arrived at what was known as the bending department, a large rectangular building in which were located nine furnaces. A steam hydraulic jib crane served two furnaces and stood at right angles to the track when the jib was in position for receiving a load. With the aid of a spreader of proper length and suspended hooks and chains at each end, the lifts of varying sizes were removed from the truck either to the floor for storage or swung around to the receiving benches of the bending furnace. There was a crew of men consisting of a foreman and as high as 40 men in this department known as the iron gang, whose duties were to handle the plates of various widths and weights and assemble them for the first stage of the process. They worked as teams of 4 or 8, as the case might be, principally in daylight, and all on day wage.

Bending Furnace No. 1.—Bending furnace No. 1 was a rectangular furnace fired with artificial gas, having a hearth area of 8 by 24 feet, in which a low temperature was maintained by a nonoxidizing flame, in charge of an operator known as a bender.

1. Charging.—The stock lying on the floor was placed in the bending furnace by four men, distributed at equal distances along the plate, reaching down and picking up each plate separately and launching it into the furnace by a running movement, placing as many across the hearth of the furnace as the width of the plate would permit. They were known as the charging gang, day wage, 10 hours; the occupation being very laborious and uncomfortable and requiring physical endurance rather than skill. In summer time the condition under which they worked would be extremely uncomfortable and the tax so great that it was almost impossible to keep men on the job. On extremely hot days it would often be necessary to double and treble the number of this crew.

1910: The skelp is now charged entirely by a machine which eliminates practically all heavy manual labor and does not require the constant exposure of workmen to high temperatures.

2. Bender (1, 10 hours, day wage):

His position was at the discharge end of the furnace, working 45 minutes out of every hour and then relieved by a spell hand. This spell bender rotated on three bending furnaces, spelling the respective benders. The position was a skilled one and required the man to stand very close to the opening of the furnace while doing his work. A water shield, between the man and the side of the furnace, partially covered the opening and also the side of the furnace. Compared with the present time, the occupation was a very laborious and uncomfortable one, due to the low roof of the building and poor ventilation; often the air that was supplied by a system of overhead piping for the purpose of making it more bearable was really warm air when delivered to him. His tools consisted of a pair of long reined tongs, with which he caught a piece of skelp in the furnace and by main strength dragged it out to a point where it could be caught by the chain tongs. In addition to regulating the temperature of his furnace, it was also part of his duties to change dies when necessary or as directed by the general foreman of the department. He was assisted by two men known as tong runner and roller-off.

Tong Runner (1, 10 hours, day wage):

He caught the skelp at the bending die in the jaw of the lazy tongs, mounted at right angles to its axis on a trolley which traversed a bench on which was moving an endless chain, the wheels of the trolley straddling the chain, and the hook of the chain tongs was engaged in one of the links of the chain and drawn forward, pulling the plate into the die and giving it a cylindrical formation. The tong runner moved along the floor with the travel of the tongs and disengaged them when the piece was released from the die. In winter this man worked continuously, but in summer he was spelled every 45 minutes for 15 minutes out of the hour by a spell hand who rotated on three furnaces, spelling 45 minutes out of every hour.

Roller-Off (1, 10 hours, day wage):

His duties were to take the partially formed pipe and roll it down slightly inclined skids, where two trucks of peculiar build awaited its reception. These trucks had a solid axle with a pair of cast-iron wheels about 12 inches in diameter. On the axle was attached a circular plate acting similarly to a fifth wheel of a wagon. There was a bolster piece on which were mounted two uprights about 36 inches apart and 4 feet high. These trucks had a T handle integral with the axle and about 12 inches from the axle. They were bent upward to an angle of about 45°. This form of construction always kept the handle in a position about waist high. The partially formed pipe was rolled onto these two trucks, and when the trucks were filled the rapid-transit power of that day, "the mule," was attached to one of the handles and the load conveyed across the very irregular floor to the welding department or to some place for stocking. In the process of movement, while the mule was pulling on the handle of the forward truck the rear truck handle was being controlled by a laboring man who steered it around the sharp turns.

The same conditions prevailed at bending furnaces Nos. 2, 3, 6, 7, and 8 as already described at No. 1, with the exception that instead of the charging of the plate being done manually by a crew of four or more men, depending on the weather conditions, the plates were placed on a charging bench and were mechanically introduced into the furnace. Bending furnaces Nos. 4 and 5 were different, in that they had power rolls that drew the plate from the furnace and beveled the edges, instead of the dies and chain tongs previously mentioned.

It is not possible to give in sequence the operations of the old mill at this period for the reason that the requirements of the mill were such that continuity in handling and conversion could not be maintained. Material prepared on the various bending furnaces would not be distributed to the welding furnace of a corresponding number. This meant the crossing and recrossing of the material during the successive steps of manufacture. There being no dividing wall between the bending and welding departments, the progress of the material was therefore over a very irregular floor level, and under all manner and kinds of roof construction—iron and steel, wood frame, metal sheathed, etc.—the whole tending to pocket the heat and allowing little or no ventilation.

1910: All processes of tube manufacture are in 1910 brought together in a single enormous building. Each bending furnace has its corresponding welding furnace and the material thus passes in an orderly manner through all the successive processes, thus greatly increasing the output and at the same time reducing the liability of accidents. All materials or products are handled by mechanical devices, cranes, conveyers, motor-driven machines, or power lifts, thus eliminating not only the necessity for excessive exertion on the part of the workmen, but also doing away with the obnoxious presence of the mules. All furnaces have water-cooled doors, and in addition large electric fans are placed at every working position which is in a zone of high temperature. The workmen are now spelled every 40 minutes, and thus get 20 minutes' rest in every hour instead of the 15 minutes specified above. There are also minor changes in equipment, too numerous even to mention, which greatly improve the working conditions.

WELDING DEPARTMENT.—This department consisted of 8 welding furnaces in a row, all of rectangular shape and of various dimensions suitable for the respective classes of work. Elsewhere standing at right angles to this row were located two more welding furnaces, Nos. 9 and 10, and then in a remote corner of the plant one other furnace, No. 11.

WELDING FURNACE No. 1.—As the skelp came from the bending department it was distributed to the welding department, consisting of 8 furnaces in a row. The machinery was all driven from one main line shaft in a pit beneath the floor level, no separately electric driven units or individual motive power being used. The hearth of these furnaces was so near the floor line that it was necessary to have an operating pit probably 2 feet below the floor level to enable the operators to work before them.[1]

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[1] In 1910 the furnace hearths are raised well above the floor so as to avoid the hot and dangerous pits. All machinery is electrically driven and organized in small units, so that any part of the machinery can be shut down without interfering with the rest of the plant. This is a great feature in the prevention of accidents.

As previously stated, the skelp was brought to the charging end of the furnace and tipped over in a loose pile on the floor parallel to this pit. On the smaller sizes of pipe it was the duty of two men to pick the skelp up, one man at each end, and launch it into the furnace. These men were known as—

PIT HANDS (2, 10 hours, day wage):

The man on the forward end of the pipe placed it in the furnace door and the one on the far end shoved it into the furnace. These men alternated period about at the ends of the pipe. The man on the forward end had an S hook with which he lifted the front end of the pipe into the furnace, and the man who shoved the pipe into the furnace used a plain wooden stick.[1] These men had no duties to perform other than above described.

WELDER (1, 10 hours, per diem and salary):

A skilled man and the one responsible for the condition of the finished product. His duties were to regulate the temperature of his furnace, controlling the gas and air valves for this purpose. He had assistants who aided him with the various work about the furnace, and they were known as pit hands. The tool used by the welder was one known as a pusher, a bar with a fork on the end, about 22 feet long with a loop handle, which he used for pushing the pipe out of the furnace.

ADDITIONAL PIT HANDS (1, 10 hours, day wage):

In addition to the pit hands previously mentioned who had specific duties, additional pit hands were furnished with general duties to perform, the number varying with the size of the pipe being made. The permanent additional pitman assisted the welder by picking up the respective tools and placing them in position for use, helping the welder to push the pipe from furnace, etc. He worked under the same conditions of physical discomfort as the welder and other furnace hands.

TURNER-DOWN (1, 10 hours, day wage):

Then, as in 1910, this man's duty was to turn the skelp, previously charged in the furnace by pit hands, over into the center, or "gutter" portion of furnace hearth, with the lapped edges up in position to be brought to a welding heat. The welder and turner-down alternated in the performance of the work attached to these occupations, obtaining thereby a "spell" or relief from the more taxing duties of the forehand job, and with the assistance of the help constituted a team. In summer time spell hands were furnished to the number required by ordinary weather conditions; however, in extreme cases there was no limit to such additional help.

SKELPER (1, 10 hours, day wage):

His duty was to arrange the skelp in an orderly way, parallel with the pit, that the pit hands could the more readily pick it up for charging in furnace, using as his only tool a stick which he inserted in the end of the pipe. The foregoing constituted a crew on the front or charging end of the furnace. On the rear or roll end, being the discharge end, were found the following-named occupations:

BALLER (1, 10 hours, day wage):

His position was to one side of the welding rolls, and with a small pair of tongs picked up a ball of the proper size and placed it on the end of the welding bar, which in turn was placed in the groove between the top and bottom rolls, the space between the ball and groove being of the thickness and diameter desired for the wall of the finished pipe. This bar was held in place by a stop dropped behind it. After the pipe had passed along and over the welding bar, with the same tongs he removed the ball; the bar was withdrawn and the pipe rolled aside; the bar was then brought to its original position, a new ball placed on it, and the operation repeated. Work was not so taxing as on the front-side hands, and the intervals between pipes being welded was utilized in sitting down. Water shields on the furnace deflected the intense heat from the furnace opening.

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[1] The pipe is now charged with a mechanical pusher, which eliminates the heavy manual labor and much of the exposure to the extreme heat which formerly characterized this work.

BALL BOY (1, 10 hours, day wage):

His duty was to bring balls from the bin to the tray alongside of the baller and to keep him supplied. Neither hot nor laborious, and work intermittent.

BAR PULLER (1, 10 hours, day wage):

He operated mechanism which moved the welding bar backward and forward, neither hot nor laborious, being to one side of the work. No spell time.

TAKER-OFF (1, 10 hours, day wage):

His position in old mill was a very uncomfortable one, due to the arrangement of machinery. He took the welded pipe out of the trough from the welding rolls, rolled it down short skids to a trough parallel to welding trough, and inspected the hot pipe for bad weld or seams and any other defects. If defective, he cast it to one side in proximity to his work; if good, he pushed it into the sizing rolls, using a stick for the purpose, inserted in the end of the pipe, and on large sizes a piece of pipe or a solid bar. No spell hand on this job, his only relief being the intervals between pieces.

CROSS ROLLER (1, 10 hours, day wage):

His position was parallel to sizing rolls, and he aided the progress of the piece across skids to cross-roll trough, pushing it through cross rolls. No spell hand.

ROLLER-OFF (1, 10 hours, day wage):

A position abandoned in the new mill, due to the inclined traveling cooling beds. His duties were to take the pipe out of the trough, roll it down a short skid to a pair of trucks placed parallel to skids of the same construction as those described for use at bending furnace. When these trucks were loaded a gang of men took them away and left a pair of empty ones in place. These trucks and contents were trundled all over the mill to different distant threading floors or shipping platforms where pipe was loaded on road cars used to transport it to more distant threading floors as much as a quarter of a mile from point of manufacture, where the pipe was finished for the various kinds of joints—screw, flange, or lock.

The same positions prevailed at all of the welding furnaces, with the exceptions of Nos. 4, 5, 7, and 11, where a steam pusher was used for shoving the skelp out of the furnace instead of being done manually. This was nothing more than a long cylinder in a pit beneath the floor level, with a piston and crosshead on slides, having an arm integral with the crosshead and standing at right angles to the travel of the same, coming up through a slot in the floor, and having a notch in the top to engage the lug of the pusher. In addition, there was one extra turner-down on these furnaces, making two in number instead of one on the other furnaces.

Lap bending department.

GENERAL FOREMAN:

He had charge of all of these leading furnaces and directed the changing of roll and dies to suit the various orders.

ASSISTANT FOREMAN:

He assisted the general foreman in operating the furnaces and making tho roll changes.

INSPECTOR:

He examined and gauged the plates used in making boiler tubes, measuring the same for thickness and width, and keeping a record of the material and quantity rejected, if any. He had two laborers as assistants.

TOOL MAN:

His duties were to keep all tools and dies in first-class condition.

SCALE WHEELERS:

He removed the scale from the bending dies, scarfing rolls, and draw benches, wheeling it to distant points and dumping it into bins provided, usually located near a railroad spur, and when a carload had accumulated they loaded it on a car. Common labor.

Lap welding department.

GENERAL FOREMAN:

He had charge over all the welding furnaces and the operating of the same, and the changing of rolls, etc., to fill orders.

ASSISTANT FOREMAN:

He assisted the general foreman in operating the furnaces for production.

INSPECTOR:

This man was employed to inspect the boiler tubes, following them up through the various stages of preparation, and keeping the general foreman informed as to the nature of the defects so that the flaws could be remedied quickly.

GRINDING FOREMAN:

This man had charge of the grinding department; duties of a supervisory nature. He had the necessary number of balls supplied to the welder and directed the ball grinders, gaugers, and wheelers.

BALL GRINDERS (the number varied, usually 6, 10 hours, day wage):

At this time large grindstones were used instead of emery wheels, and the practice was to place the ball on a spindle similar to the present method and bring it in contact with the face of the stone wheel which was rotating, thus smoothing up the balls and bringing them to the size required. Water was used freely on these stones and, therefore, there was no grit in the atmosphere in which the men worked. Classified as skilled work then as now.

BALL GAUGERS (the number varied at this occupation, 10 hours):

Their duties required them to use calipers and ring gauges on the balls after coming from the grinders; practically the same as to-day.

BALL WHEELERS:

They had to load the balls in wheel barrows and take them to the rattlers; from the rattlers to the gaugers; from the gaugers to the furnaces. Day wage, 10 hours; usually common labor.

PATCHERS AND HELPERS (usually 4 to 6 men, 10 hours, day wage):

Classed as skilled men.

STICKER DRESSERS (10 hours, day wage):

They cut the balls out of the pipe and flues when they got stuck in the same during the welding process, using a sledge and cold cutter. Semiskilled labor.

CINDER WHEELERS:

The cinder usually flowed out into a trough which was slightly inclined toward the side of the furnace. When the cinder overflowed this trough it spilled out on the floor, and this man cleaned up the mess and shoveled it into a wheelbarrow and trundled it to some convenient point near a railroad spur.

SCALE WHEELERS (10 hours, day wage):

These men gathered the scale from the welding, sizing, and cross rolls, shoveled it into wheelbarrows, and conveyed it to the scale bins previously referred to.

ROLL SETTERS (usually a crew of 10 to 12 men, consisting of the principals and helpers):

They made the necessary changes at the welding rolls, cross rolls, etc., using a block and tackle hung from the top of a temporary post which would be placed in the top of the housing where the change was being made. The operation was a manual one entirely; 10 hours; day wage; classified as skilled men.[1] When not engaged in making roll changes, they were constantly going around the mills watching the rolls to see that they were in proper working order.

SAND AND CROCKERY MEN:

These men prepared the various refractory materials used in lining the furnace hearths and delivered them to the respective furnaces; day wage; 10 hours.

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[1] In 1910 all roll changes were made with the aid of overhead cranes, which greatly shortened the process and eliminated all heavy lifting.

Gas Reversers (12 hours, day wage):

Their duties were to reverse the gas from one side of the furnace to the other side at intervals of a half hour, to tap cinder out of the furnace when necessary, and to keep the chambers of the furnace in good condition. Classified as skilled men.

Oiler (10 hours, day wage):

Duties to oil such machinery as there was; rated a little higher than common labor.

Cutter Grinders (10 hours, day wage):

These men ground the cutters of the threading machines on grindstones, the cutter being that part of the machine which cuts off the end of the pipe prior to threading. He also prepared the special cutting tool for the removal of the burr from the inside of the large sizes of pipe. He was responsible for keeping up the supply and, therefore, made frequent trips to the blacksmith shop for new ones or to have old ones redressed; skilled work.

Die Fixer:

This man ground the dies on an emery wheel at this period. There being no permanent location at this time for the care of the dies such as is provided to-day, the parts constituting the dies would be prepared at remote places. His duties, therefore, required him, with his helpers, to gather these parts from one point or another and put them in shape for use at the machines. His work was skilled, but his helpers were not.

The general conditions, as briefly stated before, were very unsatisfactory, due to the character and construction of the many additions and extensions of one kind and another that had been made in the many years since the establishment of the plan in a small way in 1870. Its growth and development was a matter of adding on just what would suit the needs at the time, at the least possible cost, rather than providing for expansion or decreasing cost of production, no thought being made for the future. Sanitation was not thought of, lavatories unknown other than an offensive smelling, rude affair, which was vermin infected. Foul smelling urinals, of wood or metal, were built in remote corners or out-of-the-way places, excreta accumulated in the common closets provided at some places and became most disgusting. Ventilation could not have been obtained if desired, because of the nondescript roof construction. Air was forced through a system of overhead pipes, with branches at the various hot spots occupied by workmen, but because of its being in these overhead metal-pipe conduits it got very warm and at the point of delivery was anything but cool; it merely created a current and that was all.[1] The buildings pocketed the heat within, and their compactness cut off all natural currents from without. The tool bosh for cooling tools was the common washing trough at the end of the day when those so disposed wished to cleanse themselves before leaving work.[2]

Lighting was first by artificial gas and oil hand torches,[3] subsequently by electric light, both arc and incandescent, and very poor at best, the buildings not permitting effective distribution. The movement of all raw material, semifinished, and finished material was done with barrows and trucks, of one type and another, by an army of men, and when too heavy for man, mules furnished the motive power. In some places a short piece of narrow gauge track and trucks were used, but invariably the motive power was man.[4]

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[1] Large electric fans were used in 1910, so arranged as to create and maintain a steady upward current of air which carried the heat over the heads of the workmen.

[2] An exceptionally good system of toilets, lavatories, and garbage cans was installed in this mill prior to 1910. The water supply is good and conveniently furnished to the workmen. The building is so large and the roof so high that smoke and fumes are never disagreeably present at the working positions.

[3] The building in 1910 was lighted by scientifically arranged arc lights.

[4] In 1910 all materials and products were mechanically handled. It was possible to reach every part of the building by some one of the many overhead cranes.

Butt weld mill.

At this period the method of making butt weld pipe, while somewhat similar to the present in practice,[1] was distinctly different in application, and was exclusively the "tagging" process.

The material having arrived on trucks from the skelp mills, the procedure was as follows:

TAGGERS AND HELPERS (working as a team, day wage, 10 hours, varying in number according to the number of furnaces at work):

A team consisted usually of a tagger and two helpers on small material. The end of the plate which was to be tagged usually had the corners partially clipped off and was put in the tagging fire and brought to a welding heat. At the same time other men were heating the tag—a small piece of round iron 4 or 5 feet long with a knob on the end. On signal, both the hot plate and the tag would be brought out and welded together, sometimes in a forming die and at other times simply by a blow of the hammer on the skelp, partially cupping it. The various sizes of skelp thus tagged would be placed in suitable buggies by the taggers to be conveyed to the respective welding furnaces by the—

SKELP TRUCKERS (6 to 8, 10 hours, day wage):

Their duties were to deliver the tagged skelp to the different furnaces.

The method of "back charging" the furnace was not in vogue at this period; charging and drawing were done on one end only. The buggy of tagged skelp stood parallel to the operating floor with the plain end toward the furnace, and was taken from this truck by—

FEEDERS (3, 10 hours, day wage; 2 working, 1 off):

They worked as a team; one man picked up the forward end of the plate and the other the rear or tag end. The man on the forward end of the plate, when light material was being worked, would slightly bend up the front end so that it would slide into the furnace readily. On the heavier plates he had a special tool similar to a gooseneck wrench, the opening of which was a little larger than the thickness of the plate, and by placing this on the end of the plate and giving it a right-angle twist accomplished the same purpose. After preparing the plate they picked it up, as previously stated, and launched it into the furnace by a running-forward movement. The hearth of the furnace sloped down from one side to the other and likewise from the front to the rear, and would usually accommodate three sheets of the tagged skelp.

WELDERS (2, 10 hours, day wage and salary):

These men were known as first and second welder. They worked alternately, dividing the period of work between themselves as to duration anywhere from 15 minutes to 1 hour. The first or second welder, as the case might be, grabbed the tag as a handle and by a swinging, twisting motion worked the plate laterally on this sloping hearth to a position immediately in front of the bell block, which was stationary, and engaged the bell, which was slipped over the tag. Recognized as responsible man on the furnace and accountable for the quantity and quality of the output.

BUGGY RUNNERS (2, 10 hours, day wage; 1 on at a time and 1 off, work periods being 20 minutes):

This job being performed by boys, the work period was limited to 20 minutes and rigidly enforced. Their duties were to move the buggy, which was a small affair with four wheels running on planes parallel with a traveling chain. Integral with this frame and standing vertically was a forked head, and when the boy moved the buggy up to the furnace the welder dropped the tag into this fork, which engaged the knob on the end of the tag, and then when the boy hooked the buggy to the traveling chain the piece was drawn through the bell out of the furnace.[2]

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[1] See Vol. I, pp. 314–322. The hot and laborious work of tagging is now completely eliminated.

[2] In 1910 hooks which are directly attached to traveling chain were used, thus doing away with the use of tags.

TAG CUTTER (1, 10 hours, day wage):

He was spelled 15 minutes out of the hour by a spell hand, who spelled successively the tag cutter, bell cleaner, and cross roller. His duties were to cut the tag off close to the end of the pipe by placing it under a small power shear located near the end of the draw bench.

ROLLER-OFF (1, 10 hours, day wage):

His duties were to take the last end of the pipe out of the furnace with a pair of tongs and slide it down skids to a trough in front of the sizing rolls, and push it into the sizing rolls.

CROSS ROLLER (1, 10 hours, day wage):

His duties were to push the pipe into the cross rolls after it had passed through the sizing rolls.

LAYER-OFF (1, 10 hours, day wage):

His duties were to take the pipe after it passed through the cross rolls and place it on the rack or cooling table, as the case might be, and straighten it out. The material was advanced from notch to notch in this rack by a whip motion on the part of this man and required considerable sleight of hand.

LAYER-OFF AND ROLLER-OFF (1, 10 hours, day wage):

His duties were to spell the roller-off and layer-off 20 minutes out of the hour, and in extremely hot weather two were in this position, increasing the spell to half-hour periods.

BELL CLEANER (1, 10 hours, day wage; this job was filled by a boy):

His duties were to take the bells and place them in a rack provided for the purpose; to pull the bells as they fell from the hot pipe into a bosh; to clean them, and place them again on the bell rack for the welder.

MARKER AND TRUCKERS (3, 10 hours, day wage; worked as a team):

The marker received 15 or 20 cents a day more than the truckers, it being his duty not only to assist in moving the trucks but to place the proper designating marks covering the quantity and dimensions on the material and disposing of it in such manner that it would apply on the orders. He in turn conveyed this information to the foreman of the threading floor. The duties of the truckers were to guide the trucks, which were drawn by a mule through the different passageways in the mill and to unload the pipe into the racks at the threading machines.

These occupations prevailed at all of the furnaces except Nos. 1 and 2, where the drawbench was of the shifting type instead of stationary and where the larger sizes of pipe were made. At these furnaces there was the occupation of—

BENCH MOVER (1, 10 hours, day wage):

This position was not such as to require a spell hand and was usually filled by boys or men minus an arm or leg.

CUTTERS AND THREADERS (10 hours, piecework; classified as semiskilled):

Two men operated machines in pairs; they cut the tag end of the pipe off on one machine and the rough butt end off on the other machine.

COUPLING SCREWERS:

In 1895 the couplings were put on entirely by hand.

TESTERS:

There were two men at each testing machine who took the pipe from the skids and placed one end against a stationary head, the other man moving the adjustable carriage against the other end. The operation was practically the same as to-day.

BUNDLERS:

Practically the same operation as to-day, except that it was contract work, one man having the contract for the whole mill.

BELT LACER AND TOOL GRINDER (a combined job, 1 man, 10 hours, day wage):

He instructed the new men how to grind their tools.

Die Fixer and Helper:

This man repaired the dies used in the threading machines by grinding them on an emery wheel. He was a skilled man, day wage, 10 hours. The helper merely secured the dies for the die fixer and removed the repaired dies to the place where they were to be used.

Scrap Shearman:

The long scrap from the machines was taken out of the mill to a point where a crocodile shear was located, where the same was cut up into shorter pieces for handling. One man, 10 hours, day wage, a little better than common labor. Helpers varied in number.

The occupations such as coupling wheelers, ash handlers, cinder wheelers, and scale wheelers were all filled by common labor, the number varying according to the operation of the mill, and the material handled was transferred from the point of origin to remote points in wheelbarrows. All 10 hour men, day wage.

The butt-welding department occupied a large rectangular building consisting of seven bays, 60 feet wide by 400 feet in length, one story, low roof, wooden construction, metal sheathed, in which were located the six welding furnaces of rectangular shape, all using artificial gas fuel. A network of shafting was hung from the roof trusses, from which were driven, by belt, the great number of threading and cutting machines. While there was a ventilator in the roofs of these bays, nevertheless it was a very uncomfortable place to work in summer, due to the low roof. Circulation of air was obtained by fans and a series of pipes with branches leading off to points around the furnaces, but the air coming from them was hot. The sanitary arrangements in this department were similar to those described above.

Coupling forge department.

In 1895 the practice of making couplings was confined entirely to the swaging process on all sizes and on various types of hammers, chiefly Bradley spring helve and single-acting steam hammers. The material for the couplings came in long bars and was cut off into suitable lengths for the different sizes. These blanks were then bent into shape and welded.

Bender-Heater:

This man, with the aid of a helper on large sizes, charged the iron bar on a peel into a heating furnace, distributing the bars over the hearth of the furnace. When brought to the proper temperature for bending, he drew the same from the furnace and slid it on skids to the top of the bending pillar, at the same time turning the bar up on its edge between the grip on the bending mandrel, one man operating the rotating head around the mandrel and bending the bar into the required form; practically the same as at the present time. The heater regulated the gas in his furnace and kept the bottom in proper shape. This was the method on all large couplings. After bending they were stacked to one side for stock or passed on to the welding furnace by telegraphing, on a single wheel trolley and suspended hook. Classified as skilled.

Heater (at steam hammer):

This man charged the bent couplings into the welding furnace and brought them to a welding heat, and when ready to draw, removed them from the furnace with the aid of a suspended hook from a single rail telegraph overhead to the die of the hammer.

Welder:

When the hot blank had been placed in the bottom die he inserted a mandrel of the required size, on which was a porter-bar to enable him to revolve the piece during the intervals between blows of the hammer. After welding the mandrel was removed and the coupling rolled down a chute to the floor. Classified as a skilled man.

Hot Sizer:

This man took the hot couplings from the chute and placed a block, of the size of the central diameter in the coupling, in the same, and with the use of a large sledge hammer rapped on the side of the hot coupling to make it round, and when it conformed properly to the sizing plug he removed the plug and turned the coupling over and inserted it in the opposite side, repeating the hammering until it was in proper shape. Designating marks were put on the couplings with the aid of hand stamps. On the small sizes of couplings, long bars were put into the furnace and heated, and when hot were cut off and bent into form in a "Blakely" bender.

Benders (piecework):

The bender charged several long bars part way in the furnace, having a series of them across the hearth. When the first one was hot he withdrew it and put it into the bending machine, which cut it off and formed it in one operation, shoving the bar in until coming to the cold part, when he returned it to the furnace, taking the second piece out of the furnace and repeating the operation. These blanks were then removed from the machine by laborers with wheelbarrows, who distributed them to the small hammers.

Heaters and Welders (piecework, 10 hours, Bradley hammers):

These men worked as a team. The heater placed the coupling blank on a short bar with the lap down in the fire, and when he took one out he put another cold one in its place, and in this way kept up a constant supply to the welder. The welder placed these hot blanks in the forming die of the hammer, having picked them up by inserting a long mandrel in them, and by pressing his foot on the treadle brought the hammer helve into play, in the head of which was the upper part of the die, turning the mandrel during the rapid action of the hammer. When completed he withdrew the mandrel and the coupling dropped into a box or barrel alongside of the hammer. These men were both classified as skilled workmen.

Coupling tap department.

This department at this period was quite a distance away from the coupling forge department, and the coupling blanks were brought to this department from the forge in wheelbarrows.

The tapping department at this period was on the ground floor of a 2-story building about 30 feet wide by 150 feet in length, and in this space was crowded a number of very ancient machines,[1] not like anything at this time. The tappers practically worked in a slop of oil with which the machines were flooded, the splashings from which saturated the ground for several feet in depth. The atmosphere was heavily charged with the fumes arising from this oil, and the workman's clothes—a short-sleeved shirt, a pair of pants cut off at the knees, and a pair of old shoes—were reeking with dripping oil. The tappers were pieceworkers, and classed as skilled workmen.

Coupling Washers:

After the couplings were tapped they were wheeled to a place where the hot soda boshes were located, where the workmen would take them and stack them on iron rods to wash in the soda water and afterwards in clear water. Common labor, 10 hours.

Inspectors:

These men inspected for imperfect threads and size. Semiskilled, 10 hours.

The finished couplings were then taken either to different points for stocking or to the pipe threading machines for immediate use.

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[1] The tapping machines used in 1910 are semiautomatic, and are without the disagreeable features described above.

APPENDIX G.—DETAILED EXHIBIT OF WORKING HOURS IN A REPRESENTATIVE STEEL PLANT.

The following tables show in considerable detail the working hours of the various shifts of workmen in the different departments of a large and representative steel plant of the Pittsburgh district. The purpose of the tables is to exhibit in a representative establishment the many interesting details regarding the time of beginning and quitting work, the amount and character of what may be called "special Sunday work," and the peculiarities of the various departments and occupations as regards working hours, which can not well be shown for the industry as a whole.

Table A shows for each department the number of men on the day shift and on the night shift working turns of different lengths on Friday, Saturday, and Sunday.

Table B shows for each department the hour of beginning and quitting work and the length of the lunch period.

Table C shows the positions in the steel works which are occupied during Sunday day turn, and the normal number of men who occupy them.

Table D shows the number of men who report for duty on Sunday ahead of their shift.

TABLE A.—NUMBER OF EMPLOYEES ON DAY SHIFT AND ON NIGHT SHIFT IN A REPRESENTATIVE STEEL PLANT IN PITTSBURGH DISTRICT WORKING TURNS OF SPECIFIED HOURS, FRIDAY, SATURDAY, AND SUNDAY, JULY 28 TO 30, 1911, BY DEPARTMENTS.

FRIDAY, JULY 28, 1911.

Departments.	Employees on day shift.				Employees on night shift.				Total employees, day shift and night shift.
	Working turns of—			Total.	Working turns of—			Total.	
	8 hours	10 hours	12 hours		8 hours	10 hours	12 hours		
STEEL WORKS AND ROLLING MILLS.									
General [1]	266	97	101	464	49	5	89	143	607
Steam	......	17	106	123	......	......	96	96	219
Electric light and power	2	83	14	99	......	......	6	6	105
Transportation	......	82	125	207	......	......	126	126	333
Mechanical [2]	3	430	27	460	1	......	65	66	526
Open hearth No. 1	2	13	103	118	......	......	103	103	221
Open hearth No. 2	2	19	210	231	......	......	192	192	423
Open hearth No. 3	1	28	248	277	......	......	270	270	547
Open hearth No. 4	......	......	163	163	......	......	133	133	296
Foundry	......	81	7	88	......	......	38	38	126
Blooming mill No 1 [3]	1	......	58	59	......	1	53	54	113
Blooming mill No 2	......	3	86	89	......	......	71	71	160
Slabbing mill No. 1	6	32	58	96	3	1	71	75	171
Slabbing mill No. 2	......	5	45	50	......	......	45	45	95
Merchant mill	......	......	30	30	......	......	28	28	58
Structural mill No. 1	......	2	85	87	......	......	86	86	173
Structural mill No. 2	......	27	135	162	......	......	117	117	279
Structural mill No. 3	......	15	224	239	......	......	154	154	393
Plate mill No 1	......	17	63	80	......	......	55	55	135
Plate mill No. 2	4	29	59	92	2	......	77	79	171
Plate mill No. 3	6	20	69	95	3	......	67	70	165
Plate mill No. 4	......	44	64	108	......	......	78	78	186
Plate mill No. 5	4	56	88	148	2	......	120	122	270
Plate mill No. 6 [4]	......	......	......	......	......	......	......	......	......
Fitting shop	......	42	30	72	......	......	14	14	86
General labor	......	506	54	560	......	49	50	99	659
Total	297	1,648	2,252	4,197	60	56	2,204	2,320	6,517
Blast furnaces	16	385	267	668	5	29	306	340	1,008

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[1] General department includes mill offices, chemical laboratory, physical laboratory, roll shop, police, watchmen, and scale shop.

[2] Mechanical department includes machine shop, carpenter shop, pipe shop, boiler shop, blacksmith shop, hammer shop, bolt and rivet department, narrow-gauge locomotive repair shop, crane repairs, bricklayers, riggers, and painters.

[3] The following dates used for blooming mill: Friday, July 21, 1911; Saturday, July 22, 1911; Sunday, July 23, 1911.

[4] Plate mill No. 6 not in operation this week.

TABLE A.—NUMBER OF EMPLOYEES ON DAY SHIFT AND ON NIGHT SHIFT IN A REPRESENTATIVE STEEL PLANT IN PITTSBURGH DISTRICT WORKING TURNS OF SPECIFIED HOURS, FRIDAY, SATURDAY, AND SUNDAY, JULY 28 TO 30, 1911, BY DEPARTMENTS—Continued.

SATURDAY, JULY 29, 1911.

Departments.	Employees on day shift.						Employees on night shift.						Total employees, day shift and night shift.
	Working 4 hours or less.	Working 4 to 8 hours	Working turns of—			Total.	Working 4 hours or less.	Working 4 to 8 hours	Working turns of—			Total.	
			8 hours	10 hours	12 hours				8 hours	10 hours	12 hours		
STEEL WORKS AND ROLLING MILLS.													
General [1]	7	2	259	94	123	485	......	......	3	......	42	45	530
Steam	......	......	......	16	99	115	......	......	......	......	45	45	160
Electric light and power	2	12	......	61	28	103	......	......	......	......	9	9	112
Transportation	4	4	......	76	117	201	1	......	......	......	78	79	280
Mechanical [2]	......	21	3	342	81	447	18	3	34	1	70	126	573
Open hearth No. 1	......	......	......	9	69	78	......	......	......	......	1	1	79
Open hearth No. 2	......	97	......	22	106	225	3	3	......	......	52	58	283
Open hearth No. 3	7	91	51	15	114	278	......	......	......	......	26	26	304
Open hearth No. 4	2	18	24	4	91	139	......	4	......	......	26	30	169
Foundry	......	1	......	77	6	84	......	......	......	......	1	1	85
Blooming mill No. 1 [3]	8	......	......	......	61	69	......	1	......	......	27	28	97
Blooming mill No. 2	......	1	......	4	90	95	......	4	......	......	26	30	125
Slabbing mill No. 1	1	1	3	32	58	95	3	......	......	......	47	50	145
Slabbing mill No. 2	6	2	......	5	47	60	......	......	......	......	21	21	81
Merchant mill	......	......	......	......	29	29	......	......	......	......	......	......	29
Structural mill No. 1	......	1	......	2	85	88	......	......	......	......	11	11	99
Structural mill No. 2	4	......	......	22	129	155	5	1	......	22	94	122	277
Structural mill No. 3	......	2	1	13	219	235	......	1	......	1	65	67	302
Plate mill No. 1	......	......	......	17	42	59	1	......	......	......	9	10	69
Plate mill No. 2	......	......	2	21	61	84	1	......	......	1	50	52	136
Plate mill No. 3	1	......	3	12	72	88	......	......	......	......	8	8	96
Plate mill No. 4	7	1	......	42	63	113	......	......	......	......	6	6	119
Plate mill No. 5	28	1	2	29	119	179	......	......	......	......	57	57	236
Plate mill No. 6 [4]	......	......	......	......	......	......	......	......	......	......	......	......	......
Fitting shop	......	8	......	35	28	71	......	......	......	......	5	5	76
General labor	7	19	......	440	60	526	......	......	......	7	15	23	549
Total	84	282	348	1,390	1,997	4,101	33	17	37	32	791	910	5,011
Blast furnaces	......	......	18	390	230	638	......	......	2	22	288	312	950

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[1] General department includes mill offices, chemical laboratory, physical laboratory, roll shop, police, watchmen, and scale shop.

[2] Mechanical department includes machine shop, carpenter shop, pipe shop, boiler shop, blacksmith shop, hammer shop, bolt and rivet department, narrow-gauge locomotive repair shop, crane repairs, bricklayers, riggers, and painters.

[3] The following dates used for blooming mill: Friday, July 21, 1911; Saturday, July 22, 1911; Sunday, July 23, 1911.

[4] Plate mill No. 6 not in operation this week.

TABLE A.—NUMBER OF EMPLOYEES ON DAY SHIFT AND ON NIGHT SHIFT IN A REPRESENTATIVE STEEL PLANT IN PITTSBURGH DISTRICT WORKING TURNS OF SPECIFIED HOURS, FRIDAY, SATURDAY, AND SUNDAY, JULY 28 TO 30, 1911, BY DEPARTMENTS—Concluded.

SUNDAY, JULY 30, 1911.

Departments.	Employees on day shift.						Employees on night shift.						Total employees, day shift and night shift.
	Working 4 hours or less.	Working 4 to 8 hours	Working turns of—			Total.	Working 4 hours or less.	Working 4 to 8 hours	Working turns of—			Total.	
			8 hours	10 hours	12 hours				8 hours	10 hours	12 hours		
STEEL WORKS AND ROLLING MILLS.													
General [1]	......	3	13	1	45	62	......	......	21	6	93	120	182
Steam	......	......	......	1	97	98	......	......	......	......	97	97	195
Electric light and power	15	1	......	9	7	32	8	......	......	......	7	15	47
Transportation	......	......	......	1	43	44	......	......	......	......	113	113	157
Mechanical [2]	13	22	......	16	2	53	1	......	......	1	61	63	116
Open hearth No. 1	5	50	......	26	24	105	......	......	......	3	90	93	198
Open hearth No. 2	47	55	2	33	41	178	......	2	......	......	166	168	346
Open hearth No. 3	3	43	5	52	56	159	......	89	......	......	263	352	511
Open hearth No. 4	7	35	2	61	25	130	......	......	1	1	124	126	256
Foundry	......	......	......	......	1	1	......	......	......	......	25	25	26
Blooming mill No. 1 [3]	......	......	......	......	1	1	......	......	......	......	57	57	58
Blooming mill No. 2	......	2	......	......	1	3	......	......	......	......	77	77	80
Slabbing mill No. 1	1	2	1	......	9	13	......	......	6	1	72	79	92
Slabbing mill No. 2	8	3	......	......	3	14	......	......	......	......	47	47	61
Merchant mill	1	......	......	......	......	1	......	......	......	......	27	27	28
Structural mill No. 1	5	......	......	......	3	8	......	......	......	......	77	77	85
Structural mill No. 2	13	9	......	......	7	29	1	......	1	......	112	114	143
Structural mill No. 3	10	3	......	......	6	19	......	......	......	......	158	158	177
Plate mill No. 1	9	1	......	......	......	10	......	......	......	......	52	52	62
Plate mill No. 2	7	2	......	......	5	14	......	3	4	1	75	83	97
Plate mill No. 3	......	......	......	......	1	1	9	2	6	1	67	85	86
Plate mill No. 4	4	3	......	......	......	7	......	......	......	......	77	77	84
Plate mill No. 5	13	6	......	1	2	22	......	......	4	......	113	117	139
Plate mill No. 6 [4]	......	......	......	......	......	......	......	......	......	......	......	......	......
Fitting shop	......	......	......	1	2	3	......	......	......	......	14	14	17
General labor	......	9	......	......	......	9	1	1	......	58	34	94	103
Total	161	249	23	202	381	1,016	20	97	43	72	2,098	2,330	3,346
Blast furnaces	......	......	7	129	197	333	......	......	2	23	244	269	602

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[1] General department includes mill offices, chemical laboratory, physical laboratory, roll shop, police, watchmen, and scale shop.

[2] Mechanical department includes machine shop, carpenter shop, pipe shop, boiler shop, blacksmith shop, hammer shop, bolt and rivet department, narrow-gauge locomotive repair shop, crane repairs, bricklayers, riggers, and painters.

[3] The following dates used for blooming mill: Friday, July 21, 1911; Saturday, July 22, 1911; Sunday, July 23, 1911.

[4] Plate mill No. 6 not in operation this week.

TABLE B.—HOUR OF BEGINNING AND HOUR OF QUITTING WORK [1] IN A REPRESENTATIVE STEEL PLANT IN PITTSBURGH DISTRICT, BY DEPARTMENTS.

Departments.	Sunday night to Saturday morning.				Saturday morning to Sunday morning.				Remarks.
	Day shift.		Night shift.		Day shift.		Night shift.		
	Hour of beginning.	Hour of quitting.	Hour of beginning.	Hour of quitting.	Hour of beginning.	Hour of quitting.	Hour of beginning.	Hour of quitting.	
	p. m.	*a. m.*	*p. m.*	*a. m.*	*a. m.*	*p. m.*	*p. m.*	*a. m.*	
Steam	6.00	6.00	6.00	6.00					Every day.
Water	6.00	6.00	6.00	6.00					Do.
Electric light and power.	6.00	6.00	6.00	6.00					Do.
Electric repair shop	6.50	5.30	5.30	5.30	6.50	4.30	None.		
Machine shop	6.50	5.30	5.30	6.30	6.50	4.30	4.30	7.00	
Blacksmith shop	6.50	5.30	5.30	6.00	6.50	4.30	5.30	6.00	
Pipe shop	6.50	5.30	5.30	6.30	6.50	4.30	6.00	7.00	
Boiler shop	6.50	5.30	5.30	6.50	6.50	4.30	4.30	7.00	
Carpenters Pattern makers Painters Tinners	6.50	5.30			6.50	4.30			Day only.
Transportation	6.30	5.30	5.30	6.30	6.30	5.30	5.30	6.30	
General labor	6.50	5.30	7.00	5.30	6.50	4.30	7.00	5.30	
Converting mill	6.00	6.00	6.00	6.00	6.00	6.00			
Open hearth No. 1	6.00	6.00	6.00	6.00	6.00	6.00			Quit early Saturday when through tapping. Charge Sunday morning 9 a.m.
Open hearth No. 2	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Open hearth No. 3	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Open hearth No. 4	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Blooming mill No. 1	6.00	6.00	6.00	6.00	6.00	6.00			Quit early Saturday if through rolling.
Blooming mill No. 2	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Merchant mill	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Structural mill No. 1	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Structural mill No. 2	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Structural mill No. 3	6.00	6.00	6.00	6.00	6.00	6.00			Do.
Slabbing mill No. 1	6.50	5.30	5.30	6.50	6.50	5.30			Do.
Slabbing mill No. 2	6.50	5.30	5.30	6.50	6.50	5.30			Do.
Plate mill No. 1	6.50	5.30	5.30	6.50	6.50	5.30			Do.
Plate mill No. 2	6.50	5.30	5.30	6.50	5.50	5.30			Do.
Plate mill No. 3	6.50	5.30	5.30	6.50	6.50	5.30			Do.
Plate mill No. 4	6.50	5.30	5.30	6.50	6.50	5.30			Do.
Plate mill No. 5	6.50	5.30	5.30	6.50	6.50	5.30			Do.
Plate mill No. 6	6.50	5.30	5.30	6.50	6.50	5.30			Do.
Rivet and bolt	6.00	6.00			6.00	6.00			Day only.
Foundry	6.50	5.30	6.00	6.00	6.50	4.30			
Fitting shop	6.50	5.30			6.50	4.30			Do.

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[1] Lunch periods (day and night) as follows:

Slabbing mill No. 1 and merchant mill: 30 minutes some time between 11 and 1 o'clock.

Plate mills, Nos. 1 to 5: 60 minutes some time between 11 and 1 o'clock.

Electrical repair shop, machine shop, blacksmith shop, pipe shop, boiler shop, carpenters, pattern makers, painters, tinners, general labor, rivet and bolt shop, foundry and fitting shop: 30 minutes, 12 to 12.30 o'clock.

Steam, water, electric light and power, transportation, converting, open hearth, blooming mills, slabbing mill No. 2, and all structural mills: No stop for lunch. Men eat lunch while at work, or during delays and intermittent idle periods.

TABLE C.—POSITIONS IN A REPRESENTATIVE STEEL PLANT[1] NORMALLY REQUIRED TO BE OCCUPIED ON SUNDAY DAY SHIFT, BY DEPARTMENTS.

ENTIRE SHIFT.

Departments.	Positions.	No. of employees.	Remarks.
Accounting	Time takers	10	
Do	Store hand	1	
Beam-fitting office	Janitor	1	
Electric	Engineer	1	
Do	Engineer's assistant	1	
Do	Engine wiper	1	
Do	Dynamo tender	1	
Do	Switchboard man	1	
General labor	Watchman	1	
Transportation	Yard masters	2	
Do	Engineers	10	
Do	Firemen	12	
Do	Conductors	8	
Do	Brakemen	9	
Do	Flagman	1	
Do	Car inspectors	5	
Do	Engine repairmen	4	
Do	Car-service clerk	1	
Do	In-bound yard clerk	1	
Open hearth No. 1	Gas tenders (first helpers)	10	
Do	Door operators	4	
Do	Motor inspector	1	
Do	Hydraulic men	2	
Do	Water carrier	1	
Do	Clean up	1	
Open hearth No. 1, mixing house	Foreman	1	
Do	Limestone handlers	5	
Do	Craneman	1	
Do	Pan man	1	
Open hearth No. 2	Gas tenders (first helpers)	16	
Do	Door operators	4	
Do	Motor inspector	1	
Do	Motor inspector (helper)	1	
Do	Hydraulic man	1	
Do	Hydraulic man (helper)	1	
Open hearth No. 2, metal mixer	Foreman	1	
Do	First helper	1	
Do	Craneman	1	
Do	Ladle liner	1	
Do	Laborers	2	
Do	Weighmaster (hot metal)	1	
Open hearth No. 3	Gas tenders (first helpers)	24	
Do	Door operators	12	
Do	Motor inspector	1	
Do	Motor inspector (helper)	1	
Do	Millwright	1	
Do	Millwrights (helpers)	2	
Do	Greaser	1	
Do	Hydraulic man	1	
Do	Water carriers	2	
Open hearth No. 3, mixing house	Pan men	2	
Do	Limestone handlers	14	
Open hearth No. 4	Gas tenders (first helpers)	14	
Do	Door operators	7	
Do	Mixer man	1	
Do	Mixer man (helper)	1	
Blooming mill No. 1	Gas tender	1	
Blooming mill No. 2	....do	1	
Blooming mills Nos. 1 and 2	Pump engineer	1	
Structural mill No. 2	Gas tender	1	
Do	....do	1	
Merchant and structural mill	Pump engineer	1	
Do	Gas tender	1	
Structural mill No. 3	....do	1	
Do	....do	1	
Do	Pump engineer	1	
Slabbing mill No. 1	Gas tenders	2	
Do	Pump engineers	2	
Do	Pump engineer (helper)	1	
Do	Head motor inspector	1	
Do	Mill messenger	1	
Slabbing mill No. 2	Gas tenders	2	
Do	Pump engineer	1	
Plate mills Nos. 1 and 4	Gas tender	1	
Plate mill No. 2	....do	1	
Do	Pump engineer	1	

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[1] At the blast furnaces all positions are occupied Sunday day turn except in the accounting and mechanical departments.

TABLE C.—POSITIONS IN A REPRESENTATIVE STEEL PLANT[1] NORMALLY REQUIRED TO BE OCCUPIED ON SUNDAY DAY SHIFT, BY DEPARTMENTS—Concluded.

ENTIRE SHIFT—Concluded.

Departments.	Positions.	No. of employees.	Remarks.
Plate mill No. 3	Gas tender	1	
Do	Pump engineer	1	
Plate mill No. 5	Gas tender	1	
Steam	River pump engineer	1	
Do	Water tenders	16	
Do	Water tenders (helpers)	3	
Do	Coal conveyor men	9	
Do	Ash conveyor men	1	
Do	Firemen	33	
Do	Coal passers	17	
Do	Ash men	25	

PART OF SHIFT.

Departments.	Positions.	No. of employees.	Remarks.
Open hearth	Second helpers	54	3 to 9 hours.
Do	Cinder-pit men	26	Do.
Do	Weighmasters	10	Do.
Do	Stockers	60	Do.
Do	Stock cranemen	17	Do.
Do	Hook ons	12	Do.
Do	Hot-metal cranemen	3	Do.
Do	Ingot distributors	2	Paid for time worked.
Do	Checker laborers	3	Do.

TABLE D.—NUMBER OF EMPLOYEES IN A REPRESENTATIVE STEEL PLANT IN PITTSBURGH DISTRICT WHO REPORT FOR DUTY ON SUNDAY PREVIOUS TO THEIR REGULAR SHIFT, BY DEPARTMENTS, OCCUPATIONS AND TIME WORKED.

OPEN HEARTH.

No. employees.	Occupations.	Time worked.	Remarks.
22	Narrow-gauge locomotive engineers.	3 to 9 hours	Wash out and light up locomotive and start operation of plant; paid one-half turn at day rate for washing out and portion of tonnage turn for starting operations.
22	Narrow-gauge switchmen	do	Do.
12	Charging-machine operators	do	Charge furnaces; paid portion of tonnage turn.
3	Charging cranemen	do	Do.
10	Second helpers	do	Start operations; paid portion of tonnage turn.
40	Cinder-pit men	do	Do.
10	Stopper setters	3 to 6 hours	Do.
10	Nozzle setters	do	Do.
9	Nozzle setters (helpers)	do	Do.
10	Steel pourers	do	Do.
12	Platform men	do	Do.
15	Ladle cranemen	do	Do.
8	Car-pusher operators	do	Do.
13	Ingot pitmen	do	Do.

BLOOMING MILL No. 1.

No. employees.	Occupations.	Time worked.	Remarks.
1	Charging cranemen	8 to 10 a. m.	Charge soaking pits. Tonnage rate covers the work of charging on Sunday. As compensation, work is light the last few hours on Saturday when these men "draw" but do not "charge."
1	Pit tongsmen	do	Do.
1	Cover pullers	do	Do.
1	Pit recorders	do	Do.
1	Roll engineers	5 to 6 p. m.	Oil and inspect engine; paid for time worked.
1	Shear engineers	do	Do.
1	Millwrights	do	Inspect machinery; paid for time worked.
1	Millwrights (helpers)	do	Do.

TABLE D.—NUMBER OF EMPLOYEES IN A REPRESENTATIVE STEEL PLANT IN PITTSBURGH DISTRICT WHO REPORT FOR DUTY ON SUNDAY PREVIOUS TO THEIR REGULAR SHIFT, BY DEPARTMENTS, OCCUPATIONS, AND TIME WORKED—Contd.

BLOOMING MILL No. 2.

No. employees.	Occupations.	Time worked.	Remarks
1	Charging cranemen..........	8 to 10 a. m...	Charge soaking pits. See blooming mill No. 1.
1	Furnace recorders..........	.....do........	Do
1	Roll engineers..........	5 to 6 p. m....	Oil and inspect engine; paid for time worked.
1	Roll engineers, floormen.....	.....do........	Do.
1	Shear engineers..........	.....do........	Do.
1	Millwrights..........	.....do........	Oil and inspect machinery; paid for time worked.
1	Millwrights (helpers)........	.....do........	Do.
1	Greasers..........	.....do........	Grease tables; paid for time worked.

MERCHANT MILL.

1	Heaters..........	4 to 6 p. m....	Charge furnace. See blooming mill No. 1.
4	Chargers..........	.....do........	Do.
1	Roll engineers..........	5 to 6 p. m....	Oil and inspect engine; paid for time worked.

STRUCTURAL MILL No. 1.

3	Heaters..........	4 to 6 p. m....	Charge furnace. See blooming mill No. 1.
2	Charging-machine operators.	.....do........	Do.
3	Furnace laborers..........	.....do........	Charge furnace; paid for time worked.
1	Furnace recorders..........	.....do........	Charge furnace. See blooming mill No. 1.
1	Roll engineers..........	5 to 6 p. m....	Oil and inspect engine; paid for time worked.
1	Saw engineers..........	.....do........	Do.

STRUCTURAL MILL No. 2.

1	Charging cranemen..........	8 to 10 a. m...	Charge soaking pits. See blooming mill No. 1.
1	Pit tongsmen..........	.....do........	Do.
1	Furnace recorders..........	.....do........	Do.
1	Heaters..........	4 to 6 p. m....	Charge furnaces. See blooming mill No. 1.
1	Charging-machine operators.	.....do........	Do.
1	Transfer tablemen..........	.....do........	Do.
1	Door operators..........	.....do........	Do.
2	Roll engineers..........	5 to 6 p. m....	Oil and inspect engine; paid for time worked.
2	Saw engineers..........	.....do........	Do.
2	Roll greasers..........	.....do........	Heat and grease rolls; paid for time worked.

STRUCTURAL MILL No. 3.

1	Charging cranemen..........	7 to 9 a. m....	Charge soaking pits. See blooming mill No. 1.
1	Cover pullers..........	.....do........	Do.
1	Pit tongsmen..........	.....do........	Do.
1	Furnace recorders..........	.....do........	Do.
1	Roll engineers..........	5 to 6 p. m....	Oil and inspect engine; paid for time worked.
1	Roll engineers (helpers).....	.....do........	Do.
1	Millwrights..........	.....do........	Oil and inspect machinery; paid for time worked.
3	Millwrights (helpers)........	.....do........	Do.
1	Narrow-gauge locomotive engineers.	3 to 6 hours...	Wash out locomotive; paid one-half turn perj ob.
1	Narrow-gauge switchmen...	.....do........	Do.

SLABBING MILL No. 1.

2	Heaters..........	12 to 6 p. m...	Watch steel in soaking pits; paid for time worked.
1	Roll greasers..........	4 to 6 p. m....	Heat and grease rolls; paid for time worked.
1	Engine wipers..........	.....do........	Oil and inspect engines; paid for time worked.

SLABBING MILL No. 2.

1	Roll greasers..........	3 to 6 p. m....	Heat and grease rolls; paid for time worked.
1	Engine wipers..........	.....do........	Oil and inspect engines; paid for time worked.
2	Narrow - gauge locomotive engineers.	3 to 6 hours...	Wash out locomotive; paid one-half turn per job.
1	Narrow - gauge locomotive switchmen.	.....do........	Do.

TABLE D.—NUMBER OF EMPLOYEES IN A REPRESENTATIVE STEEL PLANT IN PITTSBURGH DISTRICT WHO REPORT FOR DUTY ON SUNDAY PREVIOUS TO THEIR REGULAR SHIFT, BY DEPARTMENTS, OCCUPATIONS, AND TIME WORKED—Concld.

PLATE MILL No. 1.

No. employees.	Occupations.	Time worked.	Remarks.
1	Heaters	3 to 6 p. m.	Watch steel in furnace; paid for time worked.
1	Charging-machine operators.	1 to 3 p. m.	Charge furnace; paid at job rate.
1	Furnace recorders	do	Charge furnace; paid one-half turn per job.
1	Door operators	1 to 6 p. m.	Charge furnace; paid for time worked.
1	Engine wipers	2 to 6 p. m.	Oil and inspect engines; paid for time worked.
1	Rollers	4 to 6 p. m.	Line up mill; paid for time worked at hour rate.
1	Screwmen	do	Do.
1	Guidemen	do	Do.
1	Salters	do	Do.
1	Narrow - gauge locomotive engineers.	3 to 6 hours	Wash out locomotive; paid one-half turn per job.
1	Narrow-gauge switchmen	do	Do.

PLATE MILL No. 2.

No. employees.	Occupations.	Time worked.	Remarks.
1	Heaters	4 to 6 p. m.	Watch steel in furnace; pad for time worked.
1	Charging-machine operators.	12 to 2 p. m.	Charge furnace; paid at job rate.
1	Door operators	12 to 6 p. m.	Charge furnace; paid for time worked.
1	Gas tenders	do	Watch gas; paid for time worked.
1	Roll greasers	3 to 6 p. m.	Heat and grease rolls; paid for time worked.
4	Roll hands	4 to 6 p. m.	Line up mills; paid for time worked at hour rate.
1	Roll engineers	3 to 6 p. m.	Oil and inspect engines; paid for time worked.
1	Shear engineers	do	Do.
1	Motor inspectors	4 to 6 p. m.	Inspect electric machinery; paid for time worked.

PLATE MILL No. 3.

No. employees.	Occupations.	Time worked.	Remarks.
1	Door operators	3 to 6 p. m.	Charge furnace; paid for time worked.
1	Charging-machine operators.	do	Do.
1	Furnace recorders	do	Do.
1	Roll engineers	do	Oil and inspect engines; paid for time worked.
1	Roll engine wipers	do	Do.
1	Narrow - gauge locomotive engineers.	3 to 6 hours	Wash out locomotive; paid one-half turn per job.
1	Narrow-gauge switchmen	do	Do.

PLATE MILL No. 4.

No. employees.	Occupations.	Time worked.	Remarks.
1	Door operators	1 to 6 p. m.	Charge furnace; paid for time worked.
1	Charging-machine operators.	1 to 3 p. m.	Charge furnace; paid at job rate.
1	Furnace recorders	do	Charge furnace; paid one-half turn per job.
1	Heaters	3 to 6 p. m.	Watch steel in furnace; paid for time worked.
1	Roll greasers	4 to 6 p. m.	Heat and grease rolls; paid for time worked.
1	Roll engineers	do	Oil and inspect engines; paid for time worked.

PLATE MILL No. 5.

No. employees.	Occupations.	Time worked.	Remarks.
1	Door operators	1 to 6 p. m.	Charge furnace; paid for time worked.
1	Charging-machine operators.	1 to 3 p. m.	Charge furnace; paid at job rate.
1	Furnace recorders	do	Charge furnace; paid one-half turn per job.
1	Roll greasers	4 to 6 p. m.	Heat and grease rolls; paid for time worked.
1	Roll engineers	3 to 6 p. m.	Oil and inspect engines; paid for time worked.
1	Roll engine wipers	do	Do.
1	Narrow - gauge locomotive engineers.	3 to 6 hours	Wash out locomotive; paid one-half turn per job.
1	Narrow-gauge switchmen	do	Do.

PLATE MILL No. 6.

No. employees.	Occupations.	Time worked.	Remarks.
1	Door operators	3 to 6 p. m.	Charge furnace; paid for time worked.
1	Charging-machine operators.	do	Charge furnace; paid at job rate.
1	Furnace recorders	do	Charge furnace; paid for time worked at hour rate.
1	Roll greasers	4 to 6 p. m.	Heat and grease rolls; paid for time worked.
1	Roll engineers	3 to 6 p. m.	Oil and inspect engines; paid for time worked.
1	Roll engine wipers	do	Do.
1	Narrow - gauge locomotive engineers.	3 to 6 hours	Wash out locomotive; paid one-half turn per job.
1	Narrow-gauge switchmen	do	Do.

APPENDIX H.—PLANS FOR THE ELIMINATION OF 7-DAY WORK.

In order to secure information as to the character of the various plans proposed for relieving workmen in 7-day occupations on one day of the week and to discover to what extent they had actually been introduced, answers to the schedule of inquiries shown below were obtained from practically all the important plants in the United States.

SCHEDULE OF INQUIRIES REGARDING PLANS FOR THE ELIMINATION OF 7-DAY WORK.

No. 1. Has the plan proposed by the American Iron and Steel Institute for the elimination of 7-day work for individual employees been put into effect in this plant?

No. 2. Has any other plan for the elimination of 7-day work for individual employees been put into effect?

  a. If so, please furnish a description, with diagrams, of the plan used, showing particularly how the change of shift is managed.

No. 3. If any plan for the elimination of 7-day work has been introduced,

  a. When was it put into operation?

  b. What was the normal proportion of men working 7 days in each department before the plan was put into operation?

  c. What is the normal proportion of men working 7 days in each department now?

  d. How many extra men (relief men) does the operation of the plan require when the plant is running full?

  e. What changes in tonnage or hourly rates of wages were made as a result of the introduction of this plan?

  f. What changes in cost of production have followed the introduction of the plan?

  g. What has been the attitude of the workmen toward the introduction of the plan?

No. 4. What permanent changes have been made in the past year in the working hours of employees other than those working 7 days per week?

  a. Changes in hours per day?
    In what occupations?
    Affecting how many men?

  b. Changes in hours per week?
    In what occupations?
    Affecting how many men?

No. 5. What improvements in sanitation and general physical conditions have been made in the past year?

The character of the plans introduced is best illustrated by a series of six schemes which show the way in which the relief of the men in typical 7-day occupations is effected. Each of these six schemes represents the system in use throughout one or more important plants.

In explanation of the schemes and in order to convey some idea of the results of the introduction of the plans, the answers of each of the six plants to the schedule of inquiries printed above are shown in connection with the scheme to which they apply. The answers in each case are numbered to correspond with the inquiries in the schedule.

For further discussion of these schemes see page 166.

SCHEME FOR THE ELIMINATION OF 7-DAY WORK AT PLANT A: BLAST FURNACES AND STEEL WORKS.

Check number.	First week.							Second week.							Third week.							Fourth week.						
	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
1......	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓
2......	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓
3......	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓
4......	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓
5......	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓
6......	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1 **24**	✓	✓	✓	✓	✓	✓	✓
Extra Crew.	6														6													

Bold-face figures represent hours of rest period.
1 represents one day turn of 12 hours.
✓ represents one night turn of 12 hours.

PLANT A: BLAST FURNACES AND STEEL WORKS.

ANSWERS TO INQUIRIES OF SCHEDULE ON PAGE 541.

No. 1. No.

No. 2. Yes.

a. BLAST FURNACE PLAN.—Turns change each week. Men work 6 days followed by a rest period of 24 hours, and 7 nights followed by a rest period of 24 hours. No long turns are worked. The above plan shows that one extra crew relieves each of the six regular crews one day each week.

STEEL WORKS PLAN.—Operations are suspended for 24 hours at the week end so that practically all men work only 6 days. Some few positions in the gas producers and open-hearth furnaces are continuous and men occupying these positions are relieved for 24 hours after 6 days have been worked, and for 24 hours after 7 nights have been worked, under a plan somewhat similar to that for the blast furnace, shown above.

No. 3.

a. May 1, 1911.

b. About 19 per cent.

c. Two per cent. These, of course, are not necessarily the same men each week. Various causes contribute to this. No day passes without some employees failing through illness or other cause to report, and their positions must be filled from such men as are immediately available; sometimes this necessitates working a man the seventh and possibly the eighth day before the regular rest period; then we are confronted with breakdowns, changeable weather, and other conditions that contribute to the disarrangement of the schedules.

d. Eighty-two men.

e. None.

f. Production costs were affected to some small extent through the introduction of the extra men. For the most part they simply took the places of other men, but, in order to retain them and have a sufficient number available when needed, we must afford them a fair working period per week whether we actually need them for the full working period or not. This would have its effect on costs, as well as the fact that placing new men on unfamiliar work does not reduce repair costs nor increase product; the tendency is in the other direction.

g. At the inception of the plan the consensus of opinion of those in a position to judge the sentiment of the men was that there was almost general dissatisfaction. Since becoming reconciled to the plan a number of the men have expressed their preference for it.

No. 4.

a. None.

b. None.

No. 5. Individual modern lockers for a large number of the employees; sanitary wash-stands and closets erected; purification of drinking water; lectures by company surgeons to foremen on first aid to the injured, in works lecture room; close attention and study of cause and prevention of accidents by works executives and specially employed officials; and increased remuneration to injured married men while off duty.

SCHEME FOR THE ELIMINATION OF 7-DAY WORK AT PLANT B: BLAST FURNACES AND STEEL WORKS.

Check number.	First week.							Second week.							Third week.							Fourth week.						
	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
1	**36**	1	1	1	1	1	1 ✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**48**		1	1	1	1	1	1
2	**36**	1	1	1	1	1	1 ✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**48**		1	1	1	1	1	1
3	**36**	1	1	1	1	1	1 ✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**48**		1	1	1	1	1	1
4	**36**	1	1	1	1	1	1 ✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**48**		1	1	1	1	1	1
5	**36**	1	1	1	1	1	1 ✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**48**		1	1	1	1	1	1
6	**36**	1	1	1	1	1	1 ✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**48**		1	1	1	1	1	1
Extra crew.	6	...	...	...	...	...	...	6	...	...	...	...	...	...	6	...	...	...	...	...		6	...	...	...	...	...	...

Bold-face figures represent hours of rest period.
1 represents one day turn of 12 hours.
✓ represents one night turn of 12 hours.
1
✓ represents double turn of 24 hours worked on one calendar day.

PLANT B: BLAST FURNACES AND STEEL WORKS.

ANSWERS TO INQUIRIES OF SCHEDULE ON PAGE 541.

No. 1. No.

No. 2. Yes.

a. BLAST FURNACE PLAN.—Turns change every 2 weeks. Men work 6 days followed by a rest period of 36 hours, then 6 days and 1 night followed by a rest period of 36 hours, 6 nights followed by a rest period of 36 hours, and 5 nights followed by a rest period of 48 hours. Under this plan the men work one double turn each month. The above plan shows that an extra crew relieves the regular crew on 1 furnace 1 day each week. A second crew is provided for the opposite turn.

STEEL WORKS PLAN.—Operations are suspended for 24 hours at the week end so that practically all men work only 6 days. Some few positions in the mechanical department are continuous, and men occupying these positions are relieved once each week by extra men under a plan similar to the blast furnace plan, excepting that they do not work any double turn.

No. 3.

a. August 1, 1911.

b. Forty per cent.

c. Two per cent. These, of course, are not necessarily the same men each week. Various causes contribute to this. No day passes without some employees failing through illness or other cause to report, and their positions must be filled from such men as are immediately available; sometimes this necessitates working a man the seventh and possibly the eighth day before the regular rest period; then we are confronted with breakdowns, changeable weather, and other conditions that contribute to the disarrangement of the schedules.

d. Two hundred and fifty men.

e. None.

f. Production costs were affected to some small extent through the introduction of the extra men. For the most part they simply took the places of other men, but, in order to retain them and have a sufficient number available when needed, we must afford them a fair working period per week whether we actually need them for the full working period or not. This would have its affect on costs, as well as the fact that placing new men on unfamiliar work does not reduce repair costs nor increase product; the tendency is in the other direction.

g. The men lose the time they are off work, and in consequence their monthly wages are reduced approximately 14 per cent. On this account we have had serious labor trouble, the men claiming they were not overworked under the 7-day plan, and greatly preferring it to the present system.

No. 4.

a. None.

b. None.

No. 5. The establishment of a bacteriological laboratory, the staff of which has as one of its principal duties the examination and care of the drinking water at the various plants. By regularly keeping in touch with the quality of the drinking water it is prevented from getting into a pathogenetic condition, and the health of the men is thus safeguarded.

For the use of the workmen employed at the blast furnaces, buildings have been established and furnished, to which they may retire for eating, or for resting when not required at their respective posts.

A modern sanitary convenience building, which contains only the most modern sanitary equipment of water-closets, etc., has been built for the use of the workmen, and the whole installation follows closely the recommendations of the engineers' committee on sewage disposal.

Concerning the general physical conditions at the plant, it may be said that the aggressive campaign for the adoption of methods and installation of appliances promoting the safety of employees has been continued without interruption and with excellent results. During 1910 and 1911 we expended $22,295.11 on this work. In addition to the above, we are proceeding with the construction of a new emergency hospital. While the present quarters used for hospital purposes are quite sanitary and commodious, they are not up to the high standard set by the company. The new hospital is being built in accordance with plans and specifications prepared under the direction of the chief surgeon of the company, and will be entirely modern in arrangement and equipment.

SCHEME FOR THE ELIMINATION OF 7-DAY WORK AT PLANT C: BLAST FURNACES AND STEEL WORKS.

Check number.	First week.							Second week.							Third week.							Fourth week.						
	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
1.......	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓
2.......	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓
3.......	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓
4.......	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓
5.......	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓
6.......	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓
Extra man.	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**43**

Bold-face figures represent hours of rest period.
1 represents 1 day turn of 12 hours.
✓ represents 1 night turn of 12 hours.

PLANT C: BLAST FURNACES AND STEEL WORKS.

ANSWERS TO INQUIRIES OF SCHEDULE ON PAGE 541.

No. 1. No.
No. 2. Yes.
  a. Men change turns once each week. No long turns are worked. The attached diagram shows the change of turns and duration of rest periods.
No. 3. a. Blast furnaces, March 1, 1911; steel works, August 1, 1911.
  b. Blast furnaces, 82 per cent; steel works, 5 per cent.
  c. Blast furnaces, 4 per cent; steel works, 0.7 per cent.
  d. Blast furnaces, 115 men; steel works, 52 men.
  e. None.
  f. None.
  g. Some opposition at first on account of decreased earnings.
No. 4. a. None.
  b. None.
No. 5. Bubble drinking fountains installed at open hearth No. 4. Urinals at six different points throughout our mills. Also have made a request for appropriation for lockers and wash rooms.

SCHEME FOR THE ELIMINATION OF 7-DAY WORK AT PLANT D: BLAST FURNACES AND STEEL WORKS.

Check number.	First week.							Second week.							Third week.							Fourth week.						
	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
1	**36**	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1
2	1	**36**	1	1	1	1	1 **24**	✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓D	1	**36**	1	1	1	1	1
3	1	1	**36**	1	1	1	1 **24**	✓	✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓D	1	1	**36**	1	1	1	1
4	1	1	1	**36**	1	1	1 **24**	✓	✓	✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓D	1	1	1	**36**	1	1	1
5	1	1	1	1	**36**	1	1 **24**	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓	✓D	1	1	1	1	**36**	1	1
6	1	1	1	1	1	**36**	1 **24**	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	✓	**36**	✓D	1	1	1	1	1	**36**	1
Extra man	1	1	1	1	1	1	**48**	✓	✓	✓	✓	✓	✓	**36**	✓	✓	✓	✓	✓	✓	**24**	1	1	1	1	1	1	**36**

Bold-face figures represent hours of rest period.
1 Represents 1 day turn of 12 hours.
✓ Represents 1 night turn of 12 hours.
✓D Represents double turn of 24 hours worked on 2 calendar days.

PLANT D: BLAST FURNACES AND STEEL WORKS.

ANSWERS TO INQUIRIES OF SCHEDULE ON PAGE 541.

No. 1. No.
No. 2. Yes.
  a. BLAST FURNACE PLAN.—Turns change every 2 weeks. A rest period is provided after 6 turns have been worked. The above plan shows that 5 of the furnace front crew work a double turn once every 4 weeks. This plan also shows duration of the rest periods. Aside from the furnace front crew we have eliminated the double turn.
  STEEL WORKS PLAN.—Operations are suspended for 24 hours at the week end so that practically all men work only 6 days. Some few positions in the gas producers and open-hearth furnaces are continuous and men occupying these positions are relieved for 24 hours after 7 nights have been worked, under a plan somewhat similar to the blast-furnace plan.
No. 3. a. March 1, 1911.
  b. Sixty per cent.
  c. Seven per cent.
  d. Thirty-five men.
  e. None.
  f. Slight addition in cost, due to necessity for filling some positions with inexperienced men.

g. While there was some dissatisfaction when plan was first introduced at blast-furnace department, this feeling has disappeared and all employees seem to be satisfied.

No. 4. a. None.

No. 5. During the past year have installed service building, fitted complete with metal lockers and dining tables; also lavatory, with washstands, for accommodation of 80 men. Have placed washstands, urinals, and metal lockers in engine rooms, shops, and other places within the plant. We expect to continue this work until the welfare of our men has been taken care of to the best of our ability.

We have expended during the past year about $14,000 on about 750 recommendations for the safety of our men. These recommendations have been made by our safety committee here at the plant and the safety department in the Pittsburgh office.

SCHEME FOR THE ELIMINATION OF 7-DAY WORK AT PLANT E: BLAST FURNACES AND STEEL WORKS.

Check number.	First week.							Second week.							Third week.							Fourth week.						
	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday	Thursday.	Friday.	Saturday.
1..........	36	1	1 18	*✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	36	✓	✓	✓x	18	1	36	1	1	1	1	1	36	1	1
2..........	1	36	1 18	*✓	✓	✓	✓	36	✓	✓	✓	✓	✓	✓	✓	✓	✓x	18	1	1	36	1	1	1	1	1	36	1
3..........	1	1	42	*✓	✓	✓	✓	✓	36	✓	✓	✓	✓	✓	36	✓	✓x	18	1	1	1	1	1	1	1	1	1	36
4..........	1	1	1	48	✓	✓	✓	✓	✓	36	✓	✓	✓	✓	✓	36	✓x	18	1	1	1	36	1	1	1	1	1	1
5..........	1	1	1 18	*✓	36	✓	✓	✓	✓	✓	36	✓	✓	✓	✓	✓	24	½ 18	1	1	1	1	36	1	1	1	1	1
6..........	1	1	1 18	*✓	✓	36	✓	✓	✓	✓	✓	36	✓	✓	✓	✓	✓	24	1	1	1	1	1	36	1	1	1	1
Extra man	1	1	1 18	*✓	✓	✓	36	✓	✓	✓	✓	✓	36	✓	✓	✓	✓x	48		1	1	1	1	1	36	1	1	1

Bold face figures represent hours of rest period.
½ Represents 6-hour turn, 6 a. m. to 12 m.
1 Represents one day tu n of 12 hours.
✓ Represents one night turn of 12 hours.
*✓ Represents one 18-hour turn, 12 m. to 6 a. m.
✓x Represents one 18-hour turn 6 p. m. to 12 m.

PLANT E: BLAST FURNACES AND STEEL WORKS.

ANSWERS TO INQUIRIES OF SCHEDULE ON PAGE 541.

No. 1. No.

No. 2. Yes.

a. BLAST FURNACE PLAN.—Turns change every 2 weeks. Each man works 1 period of 12 days and 6 periods of 5 days in each 7 weeks with a rest period of 36 hours following each work period. The above plan shows a long turn of 18 hours at change of turn.

STEEL WORKS PLAN.—Operations are suspended for 24 hours at the week end, so that practically all men work only 6 days.

No. 3. a. May 1, 1911.
b. Fifty-two per cent.
c. Eight-tenths of 1 per cent.
d. Ninety men.
e. None.
f. None.
g. The general expression indicates considerable dissatisfaction because of decrease in earnings.

No. 4. a. None.
b. None.

No. 5. Two 10-seat range water-closets, two concrete urinals, one closet and shower bath at furnace office, one shower bath at blast furnaces, one wash room at machine shop with eight washbowls, three closets, and one shower bath, one drinking-water cooler, two drinking fountains, two fountains made but not installed yet, and complete installation of garbage cans.

SCHEME FOR THE ELIMINATION OF 7-DAY WORK AT PLANT F: BLAST FURNACES AND STEEL WORKS.

Check number.	First week.							Second week.							Third week.							Fourth week.						
	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
1	✓ D	1	1	1	1	1	1	1	1	1	1	1	**36**	1	1 **24**	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**36**	✓	✓	✓
2	✓ D	1	1	1	1	1	1	1	1	1	1	1	**36**	1	1 **24**	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**36**	✓	✓	✓
3	✓ D	1	1	1	1	1	1	1	1	1	1	1	**36**	1	1 **24**	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**36**	✓	✓	✓
4	✓ D	1	1	1	1	1	1	1	1	1	1	1	**36**	1	1 **24**	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**36**	✓	✓	✓
5	✓ D	1	1	1	1	1	1	1	1	1	1	1	**36**	1	1 **24**	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**36**	✓	✓	✓
6	✓ D	1	1	1	1	1	1	1	1	1	1	1	**36**	1	1 **24**	✓	✓	✓	**36**	✓	✓	✓	✓	✓	**36**	✓	✓	✓
Extra crew	......	..	..	..	..	..	..	..	..	..	..	..	6	..	....	....	...	...	6	...	...	...	...	...	6	...	...	...

Bold face figures represent hours of rest period.
1 Represents one day turn of 12 hours.
✓ Represents one night turn of 12 hours.
D Represents double turn of 24 hours worked on two calendar days.

PLANT F: BLAST FURNACES AND STEEL WORKS.

ANSWERS TO INQUIRIES OF SCHEDULE ON PAGE 541.

No. 1. No.

No. 2. Yes.

a. BLAST FURNACE PLAN.—Turns change every 2 weeks. Each man works 1 period of 12 turns and 6 periods of 5 turns in 7 weeks, with a rest period of 36 hours. Each man works a double turn once in 4 weeks. As there are 6 furnaces at this plant, 2 entire extra crews are employed, 1 for each turn. The above plan will show the method planned for change of turns.

STEEL WORKS PLAN.—Operations are suspended for 24 hours at the week end, so that practically all men work only 6 days. Some few positions in the gas producers and open-hearth furnaces are continuous, and men occupying these positions are relieved for from 24 to 36 hours after 6 days or 6 nights have been worked.

No. 3. a. August 1, 1911.
b. Thirty-five per cent.
c. One per cent.
d. One hundred and forty men.
e. None.
f. None.
g. The plan would be generally approved by Americans if in giving them the relief it could always be done on Sunday, but this is not possible. The foreign element as a rule disapprove of the plan, as they almost invariably prefer to work 7 days per week.

No. 4. a. None.
b. None.

No. 5. Improvements have been made in maintaining cleanliness in the works. Boxes and garbage cans have been placed throughout the works to receive waste paper, food left over from workmen's dinner baskets, and other miscellaneous material.

Safety appliances and devices to the extent of 238 have been installed, and 31 others are now under way. Several thousand dollars have been expended in this work.

APPENDIX I.—OPPORTUNITIES FOR WORK IN THE IRON AND STEEL INDUSTRY DURING 1910.

The following tables show for the principal producing departments the number of weeks during which the employees had an opportunity to secure work in their respective departments. In preparing this table information was obtained as to the number of turns operated during 1910 by each separate mill or other producing unit. For convenience of presentation the data were reduced to the basis of the number of full normal weeks which the principal producing departments were operated. In each case the number of employees affected by the different opportunities for work is shown.

CLASSIFIED NUMBER OF WEEKS DURING WHICH PRINCIPAL PRODUCING DEPARTMENTS WERE OPERATED AND NUMBER OF EMPLOYEES AFFECTED.

ALL DEPARTMENTS.

Classified number of weeks during which the principal producing departments were operated.	Number of employees in producing departments operated each classified number of weeks.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	All districts.
Under 20 weeks	....	358	474	193	45	1,070
20 and under 24 weeks	17	316	1,172	430	196	2,131
24 and under 28 weeks	....	115	479	666	445	1,705
28 and under 32 weeks	....	251	845	952	239	2,287
32 and under 36 weeks	198	528	1,622	1,045	775	4,168
36 and under 40 weeks	76	1,932	4,470	1,735	346	8,559
40 and under 44 weeks	249	2,096	6,052	3,906	1,345	13,648
44 and under 48 weeks	507	3,409	10,426	7,307	1,366	23.015
48 and under 50 weeks	135	2,624	6,873	3,016	871	13,519
50 and under 52 weeks	208	1,909	4,349	3,983	1,294	11,743
Full year	350	2,302	2,790	2,664	806	8,912
Total	1,740	15,840	39,552	25,897	7,728	90,757

BLAST FURNACES.

Under 20 weeks	....	101	379	87	45	612
20 and under 24 weeks	....	247	434	256	....	937
24 and under 28 weeks	....	54	....	....	314	368
28 and under 32 weeks	....	114	169	492	239	1,014
32 and under 36 weeks	....	....	165	293	309	767
36 and under 40 weeks	....	667	1,277	523	216	2,683
40 and under 44 weeks	....	1,017	1,766	1,328	1,174	5,285
44 and under 48 weeks	19	660	2,142	1,678	986	5,485
48 and under 50 weeks	....	242	1,408	1,400	797	3,847
50 and under 52 weeks	....	101	2,292	443	325	3,161
Full year	350	1,892	1,445	1,885	806	6,378
Total	369	5,095	11,477	8,385	5,211	30,537

CLASSIFIED NUMBER OF WEEKS DURING WHICH PRINCIPAL PRODUCING DEPARTMENTS WERE OPERATED AND NUMBER OF EMPLOYEES AFFECTED—Concluded.

BESSEMER CONVERTERS.

Classified number of weeks during which the principal producing departments were operated.	Number of employees in producing departments operated each classified number of weeks.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	All districts.
Under 20 weeks	....	....	....	....	....	....
20 and under 24 weeks	....	....	183	....	....	183
24 and under 28 weeks	....	....	....	200	....	200
28 and under 32 weeks	....	....	....	....	....	....
32 and under 36 weeks	....	....	154	....	216	370
36 and under 40 weeks	....	....	339	169	....	508
40 and under 44 weeks	....	....	575	61	....	636
44 and under 48 weeks	....	....	458	489	....	947
48 and under 50 weeks	....	....	1,107	335	....	1,442
50 and under 52 weeks	....	490	355	379	....	1,224
Full year	....	....	....	....	....	....
Total	....	490	3,171	1,633	216	5,510

OPEN-HEARTH FURNACES.

Classified number of weeks	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	All districts.
Under 20 weeks	....	28	....	....	....	28
20 and under 24 weeks	....	63	....	....	196	259
24 and under 28 weeks	....	....	....	219	....	219
28 and under 32 weeks	....	84	258	79	....	421
32 and under 36 weeks	90	....	240	....	40	370
36 and under 40 weeks	33	313	....	15	....	361
40 and under 44 weeks	....	63	64	110	....	237
44 and under 48 weeks	....	384	3,115	623	....	4,122
48 and under 50 weeks	....	1,340	1,025	171	....	2,536
50 and under 52 weeks	120	646	476	1,868	426	3,536
Full year	....	347	887	564	....	1,798
Total	243	3,268	6,065	3,649	662	13,887

MECHANICAL ROLLING MILLS.

Classified number of weeks	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	All districts.
Under 20 weeks	....	74	42	....	....	116
20 and under 24 weeks	17	....	504	95	....	616
24 and under 28 weeks	....	61	91	195	131	478
28 and under 32 weeks	....	22	156	57	....	235
32 and under 36 weeks	....	165	481	451	41	1,138
36 and under 40 weeks	....	457	1,304	626	....	2,387
40 and under 44 weeks	....	498	2,076	1,414	171	4,159
44 and under 48 weeks	120	1,204	2,363	3,367	....	7,054
48 and under 50 weeks	24	827	2,110	495	....	3,456
50 and under 52 weeks	34	652	307	972	543	2,508
Full year	....	63	252	....	....	315
Total	195	4,023	9,776	7,672	886	22,552

HAND ROLLING MILLS.

Classified number of weeks	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	All districts.
Under 20 weeks	....	155	53	106	....	314
20 and under 24 weeks	....	6	51	79	....	136
24 and under 28 weeks	....	....	388	52	....	440
28 and under 32 weeks	....	31	262	324	....	617
32 and under 36 weeks	108	363	582	301	169	1,523
36 and under 40 weeks	43	495	1,560	402	130	2,630
40 and under 44 weeks	249	518	1,571	993	....	3,331
44 and under 48 weeks	368	1,161	2,348	1,150	380	5,407
48 and under 50 weeks	111	215	1,223	615	74	2,238
50 and under 52 weeks	54	20	829	321	....	1,224
Full year	....	....	206	215	....	421
Total	933	2,964	9,063	4,558	753	18,271

APPENDIX J.—FULL-TIME WEEKLY EARNINGS OF EMPLOYEES.

The following table shows for the industry as a whole and separately for each department the full-time weekly earnings of all employees. The number and the per cent earning each classified amount are shown, and the data for the different industrial districts are shown separately. For discussion of this table see page 217.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT IN A FULL-TIME WEEK, BY DISTRICTS.

ALL DEPARTMENTS.

Classified full-time weekly earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $5	8	117	66	18	66	275	0.2	0.4	0.1	(1)	0.6	0.2
$5 and under $5.50	1	41	56	17	19	134	(1)	.1	.1	(1)	.2	.1
$5.50 and under $6	5	101	99	38	11	254	.1	.4	.1	0.1	.1	.1
$6 and under $6.50	7	190	205	99	60	561	.2	.7	.2	.2	5.0	.3
$6.50 and under $7	....	142	275	71	292	780	....	.5	.3	.2	2.5	.5
$7 and under $7.50	4	363	239	95	259	960	.1	1.3	.3	.2	2.2	.6
$7.50 and under $8	58	1,099	588	147	499	2,391	1.4	3.9	.7	.3	4.2	1.4
$8 and under $8.50	43	1,261	1,249	109	979	3,641	1.1	4.5	1.5	.2	8.3	2.1
$8.50 and under $9	267	1,539	1,736	82	807	4,431	6.5	5.5	2.1	.2	6.8	2.6
$9 and under $9.50	377	2,316	2,154	881	1,615	7,343	9.2	8.2	2.6	1.9	13.7	4.3
$9.50 and under $10	361	1,876	3,204	1,513	559	7,513	8.8	6.7	3.9	3.3	4.7	4.4
$10 and under $10.50	235	1,302	3,784	3,008	384	8,713	5.7	4.6	4.6	6.5	3.3	5.1
$10.50 and under $11	271	1,019	4,900	2,582	944	9,716	6.6	3.6	5.9	5.6	8.0	5.6
$11 and under $11.50	178	1,427	2,889	2,118	519	7,131	4.4	5.1	3.5	4.6	4.4	4.1
$11.50 and under $12	105	1.516	6,565	1,983	467	10,636	2.6	5.4	8.0	4.3	4.0	6.2
$12 and under $12.50	196	2,000	5,011	4,583	620	12,410	4.8	7.1	6.1	9.9	5.3	7.2
$12.50 and under $13	142	1,082	4,526	3,093	435	9,278	3.5	3.9	5.5	6.7	3.7	5.4
$13 and under $13.50	121	1,149	2,377	2,279	263	6,189	3.0	4.1	2.9	4.9	2.2	3.6
$13.50 and under $14	176	1,011	3,078	1,862	152	6,279	4.3	3.6	3.7	4.0	1.3	3.6
$14 and under $14.50	86	782	4,789	2,745	492	8,894	2.1	2.8	5.8	6.0	4.2	5.2
$14.50 and under $15	101	721	3,452	1,929	128	6,331	2.5	2.6	4.2	4.2	1.1	3.7
$15 and under $16	256	1,329	5,811	3,310	539	11,245	6.3	4.7	7.1	7.2	4.6	6.5
$16 and under $17	201	1,059	4,528	2,313	238	8,339	4.9	3.8	5.5	5.0	2.0	4.8
$17 and under $18	100	718	3,522	1,760	240	6,340	2.4	2.6	4.3	3.8	2.0	3.7
$18 and under $19	118	735	2,881	1,963	188	5,885	2.9	2.6	3.5	4.3	1.6	3.4
$19 and under $20	83	798	2,364	1,195	84	4,524	2.0	2.8	2.9	2.6	.7	2.6
$20 and under $22.50	343	898	4,490	2,146	386	8,263	8.4	3.2	5.5	4.7	3.3	4.8
$22.50 and under $25	48	429	2,667	1,500	197	4,841	1.2	1.5	3.2	3.3	1.7	2.8
$25 and under $27.50	39	263	1,555	714	76	2,647	1.0	.9	1.9	1.5	.6	1.5
$27.50 and under $30	29	322	718	477	43	1,589	.7	1.1	.9	1.0	.4	.9

$30 and under $35	57	242	1,101	688	157	2,245	1.4	.9	1.3	1.5	1.3	1.3
$35 and under $40	42	120	668	305	82	1,167	1.0	.4	.8	.7	.3	.7
$40 and under $45	13	55	287	184	18	557	.3	.2	.3	.4	.2	.3
$45 and under $50	7	33	137	104	3	284	.2	.1	.2	.2	(1)	.2
$50 and over	9	53	384	167	15	628	.2	.2	.5	.4	.1	.4
Total	4,067	28,098	82,360	46,078	11,786	172,409	100.0	100.0	100.0	100.0	100.0	100.0

BLAST FURNACES.

Under $5		5	1		28	34		0.1	(1)		0.5	0.1
$5 and under $5.50	1	6	1		10	18	0.3	.1	(1)		.2	.1
$5.50 and under $6		5			5	10		.1			.1	(1)
$6 and under $6.50		9	4		16	29		.2	(1)		.3	.1
$6.50 and under $7		7	9		71	87		.1	0.1		1.3	.3
$7 and under $7.50		15	7	2	75	99		.3	.1	(1)	1.4	.3
$7.50 and under $8		117	11	1	219	348		2.2	.1	(1)	4.0	1.1
$8 and under $8.50		276	11	3	416	706		5.3	.1	(1)	7.6	2.3
$8.50 and under $9	1	96	26	5	632	760	.3	1.8	.2	0.1	11.5	2.4
$9 and under $9.50	38	460	100	131	757	1,486	9.8	8.8	.8	1.6	13.8	4.7
$9.50 and under $10	1	165	513	113	199	991	.3	3.2	4.3	1.3	3.6	3.2
$10 and under $10.50	3	169	172	85	291	720	.8	3.2	1.5	1.0	5.3	2.3
$10.50 and under $11	38	233	283	268	546	1,368	9.8	4.5	2.4	3.2	9.9	4.4
$11 and under $11.50	38	473	270	468	221	1,470	9.8	9.1	2.3	5.5	4.0	4.7
$11.50 and under $12	23	368	1,157	579	274	2,401	5.9	7.0	9.8	6.9	5.0	7.7
$12 and under $12.50	18	793	486	180	417	1,894	4.7	15.2	4.1	2.1	7.6	6.0
$12.50 and under $13	38	507	283	532	241	1,601	9.8	9.7	2.4	6.3	4.4	5.1
$13 and under $13.50	44	400	413	544	95	1,496	11.4	7.7	3.5	6.4	1.7	4.8
$13.50 and under $14	18	347	394	299	51	1,109	4.7	6.6	3.3	3.5	.9	3.5
$14 and under $14.50	17	134	1,698	1,160	290	3,297	4.4	2.6	14.3	13.8	5.3	10.5
$14.50 and under $15	33	119	1,032	749	62	1,995	8.5	2.3	8.7	8.9	1.1	6.4
$15 and under $16	27	207	1,618	872	186	2,910	7.0	4.0	13.7	10.3	3.4	9.3
$16 and under $17	12	93	1,203	802	59	2,168	3.1	1.8	10.2	9.5	1.1	6.9
$17 and under $18	1	39	461	401	87	989	.3	.7	3.9	4.8	1.6	3.2
$18 and under $19	7	38	305	314	34	698	1.8	.7	2.6	3.7	.6	2.2
$19 and under $20	17	47	457	241	28	790	4.4	.9	3.9	2.9	.5	2.5
$20 and under $22.50	7	60	519	306	96	988	1.8	1.1	4.4	3.6	1.7	3.1
$22.50 and under $25	2	22	241	206	45	516	.5	.4	2.0	2.4	.8	1.6
$25 and under $27.50	1	4	98	84	13	200	.3	.1	.8	1.0	.2	.6
$27.50 and under $30		4	42	64	12	122		.1	.4	.8	.2	.4
$30 and under $35	2	2	25	20	8	57	.5	(1)	.2	.2	.1	.2
$35 and under $40				5	4	9				.1	.1	(1)
$40 and under $45			2			2			(1)			(1)
$45 and under $50				1		1				(1)		(1)
$50 and over												
Total	387	5,220	11,839	8,435	5,488	31,369	100.0	100.0	100.0	100.0	100.0	100.0

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[1] Less than one-tenth of 1 per cent.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT IN A FULL-TIME WEEK, BY DISTRICTS—Continued.

BESSEMER CONVERTERS.

Classified full-time weekly earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts	New England district	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $5	....	....	....	....	....	1	....	....	....	....	(1)	....
$5 and under $5.50	....	....	....	....	....	1	....	....	....	....	(1)	....
$5.50 and under $6	....	....	....	....	....	1	....	....	....	....	(1)	....
$6 and under $6.50	....	....	2	....	....	9	....	....	0.1	....	....	0.2
$6.50 and under $7	....	....	2	1	....	3	....	....	.1	0.1	....	.1
$7 and under $7.50	....	....	4	....	....	6	....	....	.1	....	....	.1
$7.50 and under $8	....	....	28	2	....	30	....	....	.9	.1	....	.5
$8 and under $8.50	....	....	30	....	....	86	....	....	.9	....	....	1.5
$8.50 and under $9	....	....	5	....	....	18	....	....	.2	....	....	.3
$9 and under $9.50	....	....	9	6	....	17	....	....	.3	.4	....	.3
$9.50 and under $10	....	....	11	2	....	232	....	....	.3	.1	....	4.1
$10 and under $10.50	....	....	25	2	....	102	....	....	.8	.1	....	1.8
$10.50 and under $11	....	....	13	10	....	60	....	....	.4	.6	....	1.1
$11 and under $11.50	....	....	43	34	....	88	....	....	1.4	2.1	....	1.6
$11.50 and under $12	....	....	194	91	....	311	....	....	6.1	5.6	....	5.5
$12 and under $12.50	....	....	337	301	....	695	....	....	10.6	18.4	....	12.4
$12.50 and under $13	....	....	262	224	....	506	....	....	8.3	13.7	....	9.0
$13 and under $13.50	....	....	150	102	....	288	....	....	4.7	6.2	....	5.1
$13.50 and under $14	....	....	138	110	....	276	....	....	4.4	6.7	....	4.9
$14 and under $14.50	....	....	389	116	....	525	....	....	12.3	7.1	....	9.3
$14.50 and under $15	....	....	203	89	....	314	....	....	6.4	5.5	....	5.6
$15 and under $16	....	....	233	75	....	365	....	....	7.3	4.6	....	6.5
$16 and under $17	....	....	161	85	....	259	....	....	5.1	5.2	....	4.6
$17 and under $18	....	....	146	57	....	218	....	....	4.6	3.5	....	3.9
$18 and under $19	....	....	149	52	....	211	....	....	4.7	3.2	....	3.8
$19 and under $20	....	....	65	39	....	121	....	....	2.0	2.4	....	2.2
$20 and under $22.50	....	....	195	40	....	274	....	....	6.1	2.4	....	4.9
$22.50 and under $25	....	....	135	45	....	185	....	....	4.3	2.8	....	3.3
$25 and under $27.50	....	....	59	29	....	100	....	....	1.9	1.8	....	1.8
$27.50 and under $30	....	....	65	19	....	91	....	....	2.0	1.2	....	1.6
$30 and under $35	....	....	81	28	....	113	....	....	2.6	1.7	....	2.0
$35 and under $40	....	....	29	33	....	64	....	....	.9	2.0	....	1.1
$40 and under $45	....	....	8	13	....	21	....	....	.3	.8	....	.4
$45 and under $50	....	....	....	14	....	14	....	....	....	.9	....	.2
$50 and over	....	....	....	14	....	14	....	....	....	.9	....	.2
Total	....	....	3,171	1,633	....	5,619	....	....	100.0	100.0	....	100.0

OPEN-HEARTH FURNACES.

Under $5	....	....	12	1	....	13	....	....	0.2	(¹)	....	0.1
$5 and under $5.50	....	....	12	....	....	12	....	....	.2	....	....	.1
$5.50 and under $6	....	....	16	22	....	38	....	....	.2	0.6	....	.3
$6 and under $6.50	....	26	28	4	4	62	....	0.8	.4	.1	0.6	.4
$6.50 and under $7	....	54	63	29	9	155	....	1.6	.9	.8	1.4	1.1
$7 and under $7.50	....	2	17	11	2	32	....	.1	.3	.3	.3	.2
$7.50 and under $8	....	55	95	3	3	156	....	1.7	1.4	.1	.5	1.1
$8 and under $8.50	....	41	31	22	2	96	....	1.2	.5	.6	.3	.7
$8.50 and under $9	55	58	29	....	....	142	22.6	1.7	.4	....	....	1.0
$9 and under $9.50	....	332	28	22	5	387	....	10.0	.4	.6	.8	2.6
$9.50 and under $10	15	191	59	56	61	382	6.2	5.7	.9	1.5	9.2	2.6
$10 and under $10.50	....	184	136	186	2	508	....	5.5	2.0	5.1	.3	3.5
$10.50 and under $11	11	89	144	77	63	384	4.5	2.7	2.1	2.1	9.5	2.6
$11 and under $11.50	4	212	149	44	9	418	1.6	6.4	2.2	1.2	1.4	2.9
$11.50 and under $12	11	222	342	97	68	740	4.5	6.7	5.1	2.6	10.3	5.1
$12 and under $12.50	23	232	647	428	14	1,344	9.5	7.0	9.6	11.7	2.1	9.2
$12.50 and under $13	11	149	306	231	78	775	4.5	4.5	4.6	6.3	11.8	5.3
$13 and under $13.50	16	204	283	263	62	828	6.6	6.1	4.2	7.2	9.4	5.7
$13.50 and under $14	9	103	604	231	16	963	3.7	3.1	9.0	6.3	2.4	6.6
$14 and under $14.50	8	113	297	196	16	630	3.3	3.4	4.4	5.3	2.4	4.3
$14.50 and under $15	5	127	207	177	9	525	2.1	3.8	3.1	4.8	1.4	3.6
$15 and under $16	8	188	437	266	23	922	3.3	5.6	6.5	7.2	3.5	6.3
$16 and under $17	7	99	376	94	71	647	2.9	3.0	5.6	2.6	10.7	4.4
$17 and under $18	6	130	293	95	9	533	2.5	3.9	4.4	2.6	1.4	3.6
$18 and under $19	9	65	227	150	16	467	3.7	2.0	3.4	4.1	2.4	3.2
$19 and under $20	14	144	224	173	6	561	5.8	4.3	3.3	4.7	.9	3.8
$20 and under $22.50	11	85	570	189	41	896	4.5	2.6	8.5	5.2	6.2	6.1
$22.50 and under $25	6	110	283	208	4	611	2.5	3.3	4.2	5.7	.6	4.2
$25 and under $27.50	4	38	198	95	20	355	1.6	1.1	2.9	2.6	3.0	2.4
$27.50 and under $30	4	21	107	57	4	193	1.6	.6	1.6	1.6	.6	1.3
$30 and under $35	....	25	257	146	37	465	....	.8	3.8	4.0	5.6	3.2
$35 and under $40	3	9	159	33	4	208	1.2	.3	2.4	.9	.6	1.4
$40 and under $45	1	10	11	38	4	64	.4	.3	.2	1.0	.6	.4
$45 and under $50	....	6	9	4	....	19	....	.2	.1	.1	....	.1
$50 and over	2	5	61	21	....	89	.8	.2	.9	.6	....	.6
Total	243	3,329	6,717	3,669	662	14,620	100.0	100.0	100.0	100.0	100.0	100.0

[1] Less than one-tenth of 1 per cent.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT IN A FULL-TIME WEEK, BY DISTRICTS—Continued.

PUDDLING AND CRUCIBLE FURNACES.

Classified full-time weekly earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district	Eastern district.	Pitts-burgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $5	....	10	3	....	....	13	....	0.3	0.1	....	....	0.2
$5 and under $5.50	....	2	....	....	....	2	....	.1	....	....	....	(1)
$5.50 and under $6	....	18	4	....	....	22	....	.5	.2	....	....	.3
$6 and under $6.50	....	24	5	....	....	29	....	.6	.2	....	....	.4
$6.50 and under $7	....	14	17	1	....	32	....	.4	.8	0.2	....	.4
$7 and under $7.50	....	55	52	....	2	109	....	1.5	2.4	....	1.4	1.5
$7.50 and under $8	52	129	4	....	2	187	6.4	3.5	.2	....	1.4	2.5
$8 and under $8.50	32	142	46	4	56	280	3.9	3.8	2.1	.7	37.8	3.8
$8.50 and under $9	60	265	12	8	....	345	7.4	7.1	.6	1.4	....	4.6
$9 and under $9.50	43	268	51	5	2	369	5.3	7.2	2.3	.8	1.4	5.0
$9.50 and under $10	50	126	93	2	....	271	6.1	3.4	4.3	.3	....	3.6
$10 and under $10.50	161	126	30	25	....	342	19.8	3.4	1.4	4.2	....	4.6
$10.50 and under $11	25	87	39	8	....	159	3.1	2.3	1.8	1.4	....	2.1
$11 and under $11.50	5	188	60	66	....	319	.6	5.1	2.8	11.2	....	4.3
$11.50 and under $12	6	130	53	18	2	209	.7	3.5	2.4	3.0	1.4	2.8
$12 and under $12.50	31	292	118	57	3	501	3.8	7.9	5.4	9.6	2.0	6.7
$12.50 and under $13	6	65	20	10	....	101	.7	1.7	.9	1.7	....	1.4
$13 and under $13.50	5	78	10	31	16	140	.6	2.1	.5	5.2	10.8	1.9
$13.50 and under $14	18	75	166	8	....	267	2.2	2.0	7.6	1.4	....	3.6
$14 and under $14.50	1	71	9	2	3	86	.1	1.9	.4	.3	2.0	1.2
$14.50 and under $15	....	149	75	106	6	336	....	4.0	3.4	17.9	4.1	4.5
$15 and under $16	21	158	139	6	6	330	2.6	4.3	6.4	1.0	4.1	4.4
$16 and under $17	42	155	182	2	40	421	5.2	4.2	8.4	.3	27.0	5.7
$17 and under $18	19	113	477	24	4	637	2.3	3.0	21.9	4.1	2.7	8.6
$18 and under $19	2	219	231	7	....	459	.2	5.9	10.6	1.2	....	6.2
$19 and under $20	9	285	120	4	....	418	1.1	7.7	5.5	.7	....	5.6
$20 and under $22.50	195	246	39	18	....	498	23.9	6.6	1.8	3.0	....	6.7
$22.50 and under $25	4	32	40	98	2	176	.5	.9	1.8	16.6	1.4	2.4
$25 and under $27.50	6	29	32	43	4	114	.7	.8	1.5	7.3	2.7	1.5
$27.50 and under $30	2	122	13	27	....	164	.2	3.3	.6	4.6	....	2.2
$30 and under $35	16	25	17	2	....	60	2.0	.7	.8	.3	....	.8
$35 and under $40	2	14	5	....	....	21	.2	.4	.2	....	....	.3
$40 and under $45	....	3	3	2	....	8	....	.1	.1	.3	....	.1

$45 and under $50			2	1		3			.1	.2		(1)
$50 and over	2	1	11	6		20	.2	(1)	.5	1.0		.3
Total	815	3,716	2,178	591	148	7,448	100.0	100.0	100.0	100.0	100.0	100.0

MECHANICAL ROLLING MILLS.

Under $5		7	25		14	46		0.2	0.2		1.5	0.2
$5 and under $5.50		2	3		3	8		(1)	(1)		.3	(1)
$5.50 and under $6		24	16			40		.6	.2			.2
$6 and under $6.50		19	27	4	2	52		.5	.3	0.1	.2	.2
$6.50 and under $7		9	33	13	1	56		.2	.3	.2	.1	.2
$7 and under $7.50		13	59	39	8	119		.3	.6	.5	.9	.5
$7.50 and under $8		94	65	4	11	174		2.3	.6	.1	1.2	.8
$8 and under $8.50		118	97	44	2	261		2.9	1.0	.6	.2	1.1
$8.50 and under $9	6	170	73	15	30	294	3.1	4.2	.7	.2	3.2	1.3
$9 and under $9.50	4	243	124	4	48	423	2.1	6.0	1.2	.1	5.2	1.8
$9.50 and under $10	8	456	109	241	88	902	4.1	11.3	1.1	3.1	9.5	3.9
$10 and under $10.50	14	229	173	127	5	548	7.2	5.7	1.7	1.7	.5	2.4
$10.50 and under $11	17	160	199	244	164	783	8.7	4.0	2.0	3.2	17.7	3.4
$11 and under $11.50	12	176	279	225	87	779	6.2	4.4	2.7	2.9	9.4	3.4
$11.50 and under $12	7	176	725	274	38	1,220	3.6	4.4	7.1	3.6	4.1	5.3
$12 and under $12.50	8	200	658	1,235	32	2,133	4.1	5.0	6.5	16.1	3.5	9.3
$12.50 and under $13	6	107	1,265	727	22	2,127	3.1	2.7	12.4	9.5	2.4	9.3
$13 and under $13.50	10	143	323	572	43	1,091	5.1	3.6	3.2	7.5	4.6	4.7
$13.50 and under $14	6	131	386	231	4	758	3.1	3.3	3.8	3.0	.4	3.3
$14 and under $14.50		136	364	453	55	1,008		3.4	3.6	5.9	5.9	4.4
$14.50 and under $15	17	66	382	237	10	712	8.7	1.6	3.8	3.1	1.1	3.1
$15 and under $16	14	230	600	689	47	1,580	7.2	5.7	5.9	9.0	5.1	6.9
$16 and under $17	16	205	497	298	22	1,038	8.2	5.1	4.9	3.9	2.4	4.5
$17 and under $18	5	113	472	287	36	918	2.6	2.8	4.6	3.7	3.9	4.0
$18 and under $19	11	92	399	245	20	767	5.6	2.3	3.9	3.2	2.2	3.3
$19 and under $20	5	105	291	220	6	627	2.6	2.6	2.9	2.9	.6	2.7
$20 and under $22.50	18	175	677	374	43	1,287	9.2	4.3	6.7	4.9	4.6	5.6
$22.50 and under $25	7	91	597	199	28	922	3.6	2.3	5.9	2.6	3.0	4.0
$25 and under $27.50	2	99	300	95	12	508	1.0	2.5	3.0	1.2	1.3	2.2
$27.50 and under $30		105	218	90	6	419		2.6	2.1	1.2	.6	1.8
$30 and under $35	2	71	247	222	12	554	1.0	1.8	2.4	2.9	1.3	2.4
$35 and under $40		22	196	117	16	351		.5	1.9	1.5	1.7	1.5
$40 and under $45		26	127	79	11	243		.6	1.2	1.0	1.2	1.1
$45 and under $50		4	60	33		97		.1	.6	.4		.4
$50 and over		7	97	35	1	140		.2	1.0	.5	.1	.6
Total	196	4,028	10,163	7,672	927	22,980	100.0	100.0	100.0	100.0	100.0	100.0

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[1] Less than one-tenth of 1 per cent.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT IN A FULL-TIME WEEK, BY DISTRICTS—Continued.

PUDDLING AND CRUCIBLE FURNACES.

Classified full-time weekly earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $5		10	3			13		0.3	0.1			0.2
$5 and under $5.50		2				2		.1				(1)
$5.50 and under $6		18	4			22		.5	.2			.3
$6 and under $6.50		24	5			29		.6	.2			.4
$6.50 and under $7		14	17	1		32		.4	.8	0.2		.4
$7 and under $7.50		55	52		2	109		1.5	2.4		1.4	1.5
$7.50 and under $8	52	129	4		2	187	6.4	3.5	.2		1.4	2.5
$8 and under $8.50	32	142	46	4	56	280	3.9	3.8	2.1	.7	37.8	3.8
$8.50 and under $9	60	265	12	8		345	7.4	7.1	.6	1.4		4.6
$9 and under $9.50	43	268	51	5	2	369	5.3	7.2	2.3	.8	1.4	5.0
$9.50 and under $10	50	126	93	2		271	6.1	3.4	4.3	.3		3.6
$10 and under $10.50	161	126	30	25		342	19.8	3.4	1.4	4.2		4.6
$10.50 and under $11	25	87	39	8		159	3.1	2.3	1.8	1.4		2.1
$11 and under $11.50	5	188	60	66		319	.6	5.1	2.8	11.2		4.3
$11.50 and under $12	6	130	53	18	2	209	.7	3.5	2.4	3.0	1.4	2.8
$12 and under $12.50	31	292	118	57	3	501	3.8	7.9	5.4	9.6	2.0	6.7
$12.50 and under $13	6	65	20	10		101	.7	1.7	.9	1.7		1.4
$13 and under $13.50	5	78	10	31	16	140	.6	2.1	.5	5.2	10.8	1.9
$13.50 and under $14	18	75	166	8		267	2.2	2.0	7.6	1.4		3.6
$14 and under $14.50	1	71	9	2	3	86	.1	1.9	.4	.3	2.0	1.2
$14.50 and under $15		149	75	106	6	336		4.0	3.4	17.9	4.1	4.5
$15 and under $16	21	158	139	6	6	330	2.6	4.3	6.4	1.0	4.1	4.4
$16 and under $17	42	155	182	2	40	421	5.2	4.2	8.4	.3	27.0	5.7
$17 and under $18	19	113	477	24	4	637	2.3	3.0	21.9	4.1	2.7	8.6
$18 and under $19	2	219	231	7		459	.2	5.9	10.6	1.2		6.2
$19 and under $20	9	285	120	4		418	1.1	7.7	5.5	.7		5.6
$20 and under $22.50	195	246	39	18		498	23.9	6.6	1.8	3.0		6.7
$22.50 and under $25	4	32	40	98	2	176	.5	.9	1.8	16.6	1.4	2.4
$25 and under $27.50	6	29	32	43	4	114	.7	.8	1.5	7.3	2.7	1.5
$27.50 and under $30	2	122	13	27		164	.2	3.3	.6	4.6		2.2
$30 and under $35	16	25	17	2		60	2.0	.7	.8	.3		.8
$35 and under $40	2	14	5			21	.2	.4	.2			.3
$40 and under $45		3	3	2		8		.1	.1	.3		.1

$45 and under $50	....	....	2	1	....	3	....	....	.1	.2	....	(¹)
$50 and over	2	1	11	6	....	20	.2	(¹)	.5	1.0	....	.8
Total	815	3,716	2,178	591	148	7,448	100.0	100.0	100.0	100.0	100.0	100.0

MECHANICAL ROLLING MILLS.

Under $5	....	7	26	....	14	46	....	0.2	0.2	....	1.5	0.2
$5 and under $5.50	....	2	3	....	3	8	....	(¹)	(¹)	....	.3	(¹)
$5.50 and under $6	....	24	16	....	....	40	....	.6	.2	....	....	.2
$6 and under $6.50	....	19	27	4	2	52	....	.5	.3	0.1	.2	.2
$6.50 and under $7	....	9	[illegible]	13	1	56	....	.2	.3	.2	.1	.2
$7 and under $7.50	....	13	[illegible]	39	8	119	....	.3	.6	.5	.9	.5
$7.50 and under $8	....	94	65	4	11	174	....	2.3	.6	.1	1.2	.8
$8 and under $8.50	....	118	97	44	2	261	....	2.9	1.0	.6	.2	1.1
$8.50 and under $9	6	170	[illegible]	15	30	394	3.1	4.2	.7	.2	3.2	1.3
$9 and under $9.50	4	243	134	4	48	438	2.1	6.0	1.3	.1	5.2	1.8
$9.50 and under $10	8	[illegible]	[illegible]	241	88	902	4.1	11.8	1.1	3.1	9.5	3.9
$10 and under $10.50	14	[illegible]	178	127	5	548	7.2	5.7	1.7	1.7	.5	2.4
$10.50 and under $11	17	[illegible]	[illegible]	244	164	783	8.7	4.0	2.0	3.2	17.7	3.4
$11 and under $11.50	12	[illegible]	[illegible]	[illegible]	87	779	6.2	4.4	2.7	2.9	9.4	3.4
$11.50 and under $12	7	[illegible]	[illegible]	274	[illegible]	1,230	3.6	4.4	7.1	3.6	4.1	5.3
$12 and under $12.50	8	[illegible]	[illegible]	[illegible]	[illegible]	2,133	4.1	5.0	6.5	16.1	3.5	9.3
$12.50 and under $13	6	[illegible]	[illegible]	727	[illegible]	2,127	3.1	2.7	12.4	9.5	2.4	9.3
$13 and under $13.50	10	[illegible]	[illegible]	573	43	1,081	5.1	2.6	3.2	7.5	4.6	4.7
$13.50 and under $14	6	[illegible]	[illegible]	[illegible]	4	758	3.1	3.3	3.8	3.0	.4	3.3
$14 and under $14.50	....	[illegible]	[illegible]	[illegible]	[illegible]	1,008	....	3.4	3.6	5.9	5.9	4.4
$14.50 and under $15	17	[illegible]	[illegible]	[illegible]	[illegible]	712	8.7	1.6	3.8	3.1	1.1	3.1
$15 and under $16	14	[illegible]	[illegible]	[illegible]	47	1,580	7.2	5.7	5.9	9.0	5.1	6.9
$16 and under $17	16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8.2	5.1	4.9	3.9	2.4	4.5
$17 and under $18	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.8	4.6	3.7	3.9	4.0
$18 and under $19	11	[illegible]	[illegible]	[illegible]	20	767	5.6	2.3	3.9	3.2	2.2	3.3
$19 and under $20	5	[illegible]	[illegible]	[illegible]	6	627	2.6	2.6	2.9	2.9	.6	2.7
$20 and under $22.50	18	[illegible]	[illegible]	[illegible]	43	1,287	9.2	4.3	6.7	4.9	4.6	5.6
$22.50 and under $25	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.6	2.3	5.9	2.6	3.0	4.0
$25 and under $27.50	2	[illegible]	[illegible]	[illegible]	12	[illegible]	1.0	2.5	3.0	1.2	1.3	2.2
$27.50 and under $30	....	[illegible]	[illegible]	[illegible]	6	419	....	2.6	2.1	1.2	.6	1.8
$30 and under $35	2	[illegible]	[illegible]	[illegible]	12	[illegible]	1.0	1.8	2.4	2.9	1.3	2.4
$35 and under $40	....	[illegible]	[illegible]	[illegible]	16	361	....	.5	1.9	1.5	1.7	1.5
$40 and under $45	....	[illegible]	[illegible]	[illegible]	11	243	....	.6	1.2	1.0	1.2	1.1
$45 and under $50	....	[illegible]	[illegible]	[illegible]	....	97	....	.1	.6	.4	....	.4
$50 and over	....	[illegible]	[illegible]	[illegible]	1	140	....	.2	1.0	.5	.1	.6
Total	195	4,083	16,163	7,672	927	[illegible]	100.0	100.0	100.0	100.0	100.0	100.0

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¹ Less than one-tenth of 1 per cent.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT IN A FULL-TIME WEEK, BY DISTRICTS—Continued.

HAND ROLLING MILLS.

Classified full-time weekly earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $5	6	14	12	2	14	48	0.6	0.4	0.1	(1)	1.6	0.2
$5 and under $5.50	....	16	10	1	5	32	....	.4	.1	(1)	.6	.2
$5.50 and under $6	1	20	34	14	2	71	.1	.5	.3	0.3	.2	.3
$6 and under $6.50	7	86	49	11	21	174	.7	2.3	.5	.2	2.4	.9
$6.50 and under $7	....	23	26	2	157	208	....	.6	.3	(1)	17.8	1.0
$7 and under $7.50	4	189	23	17	27	260	.4	5.1	.2	.3	3.1	1.3
$7.50 and under $8	4	97	53	77	93	324	.4	2.6	.5	1.5	10.5	1.6
$8 and under $8.50	5	148	44	20	24	241	.5	4.0	.4	.4	2.7	1.2
$8.50 and under $9	89	204	229	35	33	590	8.8	5.5	2.3	.7	3.7	2.9
$9 and under $9.50	119	281	386	130	97	1,013	11.7	7.5	3.9	2.6	11.0	5.0
$9.50 and under $10	102	252	422	192	29	997	10.0	6.7	4.3	3.8	3.3	4.9
$10 and under $10.50	27	115	333	309	5	789	2.7	3.1	3.4	6.2	.6	3.9
$10.50 and under $11	67	144	487	322	48	1,068	6.6	3.9	5.0	6.4	5.4	5.2
$11 and under $11.50	48	142	587	291	24	1,092	4.7	3.8	6.0	5.8	2.7	5.3
$11.50 and under $12	23	139	754	202	18	1,136	2.3	3.7	7.7	4.0	2.0	5.6
$12 and under $12.50	38	179	578	438	34	1,267	3.7	4.8	5.9	8.7	3.9	6.2
$12.50 and under $13	9	74	675	372	14	1,144	.9	2.0	6.9	7.4	1.6	5.6
$13 and under $13.50	11	75	310	201	15	612	1.1	2.0	3.2	4.0	1.7	3.0
$13.50 and under $14	55	116	290	158	26	645	5.4	3.1	3.0	3.1	2.9	3.2
$14 and under $14.50	5	115	353	134	4	611	.5	3.1	3.6	2.7	.5	3.0
$14.50 and under $15	24	70	267	106	10	477	2.4	1.9	2.7	2.1	1.1	2.3
$15 and under $16	43	176	472	155	17	863	4.2	4.7	4.8	3.1	1.9	4.2
$16 and under $17	48	128	374	170	12	732	4.7	3.4	3.8	3.4	1.4	3.6
$17 and under $18	25	98	270	164	18	575	2.5	2.6	2.8	3.3	2.0	2.8
$18 and under $19	42	85	275	122	14	538	4.1	2.3	2.8	2.4	1.6	2.6
$19 and under $20	19	103	274	114	8	518	1.9	2.8	2.8	2.3	.9	2.5
$20 and under $22.50	62	172	505	302	33	1,074	6.1	4.6	5.1	6.0	3.7	5.2
$22.50 and under $25	10	99	360	188	23	680	1.0	2.7	3.7	3.7	2.6	3.3
$25 and under $27.50	13	58	258	170	10	509	1.3	1.6	2.6	3.4	1.1	2.5
$27.50 and under $30	20	57	134	117	3	331	2.0	1.5	1.4	2.3	.3	1.6
$30 and under $35	33	110	328	201	19	691	3.2	2.9	3.3	4.0	2.2	3.4
$35 and under $40	34	74	244	92	6	450	3.3	2.0	2.5	1.8	.7	2.2
$40 and under $45	12	15	117	47	3	194	1.2	.4	1.2	.9	.3	.9
$45 and under $50	7	20	66	51	3	147	.7	.5	.7	1.0	.3	.7
$50 and over	5	40	211	91	14	361	.5	1.1	2.2	1.8	1.6	1.8
Total	1,017	3,734	9,810	5,018	883	20,462	100.0	100.0	100.0	100.0	100.0	100.0

TUBE MILLS.

Under $5						6						0.1
$5 and under $5.50						4						.1
$5.50 and under $6						4						.1
$6 and under $6.50						11						.3
$6.50 and under $7						6						.1
$7 and under $7.50						33						.8
$7.50 and under $8						20						.5
$8 and under $8.50						60						1.4
$8.50 and under $9						27						.6
$9 and under $9.50						106						2.5
$9.50 and under $10						570						13.4
$10 and under $10.50						427						10.0
$10.50 and under $11						585						13.8
$11 and under $11.50						250						5.9
$11.50 and under $12						475						11.2
$12 and under $12.50						316						7.4
$12.50 and under $13						228						5.4
$13 and under $13.50						82						1.9
$13.50 and under $14						136						3.2
$14 and under $14.50						72						1.7
$14.50 and under $15						54						1.3
$15 and under $16						249						5.9
$16 and under $17						58						1.4
$17 and under $18						107						2.5
$18 and under $19						80						1.9
$19 and under $20						36						.8
$20 and under $22.50						80						1.9
$22.50 and under $25						16						.4
$25 and under $27.50						45						1.1
$27.50 and under $30						6						.1
$30 and under $35						37						.9
$35 and under $40						47						1.1
$40 and under $45						19						.4
$45 and under $50												
$50 and over												
Total						4,262						100.0

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[1] Less than one-tenth of 1 per cent.

NUMBER AND PER CENT OF EMPLOYEES EARNING EACH CLASSIFIED AMOUNT IN A FULL-TIME WEEK, BY DISTRICTS—Concluded.

POWER, MECHANICAL, AND YARD FORCE.

Classified full-time weekly earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $5	2	75	13	15	9	114	0.2	1.0	(1)	0.1	0.3	0.2
$5 and under $5.50		11	30	16		57		.1	0.1	.1		.1
$5.50 and under $6	4	34	25	2	3	68	.3	.5	.1	(1)	.1	.1
$6 and under $6.50		18	86	74	17	195		.2	.2	.4	.5	.3
$6.50 and under $7		34	120	25	54	233		.5	.3	.1	1.6	.4
$7 and under $7.50		89	44	26	143	302		1.2	.1	.1	4.3	.5
$7.50 and under $8	2	601	318	60	171	1,152	.2	8.2	.9	.3	5.1	1.8
$8 and under $8.50		474	998	16	423	1,911		6.4	2.9	.1	12.6	2.9
$8.50 and under $9	53	734	1,348	19	101	2,255	4.0	10.0	3.9	.1	3.0	3.4
$9 and under $9.50	172	690	1,393	583	704	3,542	13.0	9.4	4.0	3.1	21.0	5.4
$9.50 and under $10	185	474	1,433	907	169	3,168	14.0	6.4	4.1	4.9	5.0	4.8
$10 and under $10.50	30	397	2,518	2,266	66	5,277	2.3	5.4	7.2	12.1	2.0	8.0
$10.50 and under $11	96	297	3,317	1,513	86	5,309	7.3	4.0	9.5	8.1	2.6	8.1
$11 and under $11.50	52	218	1,319	954	172	2,715	3.9	3.0	3.8	5.1	5.1	4.1
$11.50 and under $12	31	462	2,899	696	56	4,144	2.4	6.3	8.3	3.7	1.7	6.3
$12 and under $12.50	59	245	1,921	1,926	109	4,260	4.5	3.3	5.5	10.3	3.3	6.5
$12.50 and under $13	58	167	1,537	961	73	2,796	4.4	2.3	4.4	5.2	2.2	4.3
$13 and under $13.50	35	211	810	566	30	1,652	2.7	2.9	2.3	3.0	.9	2.5
$13.50 and under $14	66	224	1,023	771	41	2,125	5.0	3.0	2.9	4.1	1.2	3.2
$14 and under $14.50	51	199	1,629	668	118	2,665	3.9	2.7	4.7	3.6	3.5	4.1
$14.50 and under $15	21	181	1,233	465	18	1,918	1.6	2.5	3.5	2.5	.5	2.9
$15 and under $16	143	356	2,073	1,245	209	4,026	10.8	4.8	5.9	6.7	6.2	6.1
$16 and under $17	73	366	1,694	856	28	3,016	5.5	5.0	4.8	4.6	.8	4.6
$17 and under $18	41	213	1,301	732	81	2,368	3.1	2.9	3.7	3.9	2.4	3.6
$18 and under $19	39	230	1,241	1,055	100	2,665	3.0	3.1	3.5	5.7	3.0	4.1
$19 and under $20	19	99	907	396	32	1,453	1.4	1.3	2.6	2.1	1.0	2.2
$20 and under $22.50	50	147	1,909	913	147	3,166	3.8	2.0	5.5	4.9	4.4	4.8
$22.50 and under $25	19	72	998	556	90	1,735	1.4	1.0	2.9	3.0	2.7	2.6
$25 and under $27.50	13	29	573	190	11	816	1.0	.4	1.6	1.0	.3	1.2
$27.50 and under $30	3	9	128	103	15	258	.2	.1	.4	.6	.4	.4
$30 and under $35	3	6	116	64	77	266	.2	.1	.3	.3	2.3	.4
$35 and under $40			1	19		20			(1)	.1		(1)
$40 and under $45		1	2	2		5		(1)	(1)	(1)		(1)
$45 and under $50		3				3		(1)				(1)
$50 and over			4			4			(1)			(1)
Total	1,319	7,366	34,961	18,660	3,353	65,659	100.0	100.0	100.0	100.0	100.0	100.0

[1] Less than one-tenth of 1 per cent.

APPENDIX K.—OPPORTUNITIES FOR ANNUAL EARNINGS DURING 1910.

The following tables show for the industry as a whole and for each of the principal producing departments the opportunities for annual earnings which existed during 1910. By "opportunity for annual earnings" is meant the amount which a workman could earn if he worked at his regular position every day that his mill or department operated during 1910.

Table A shows the opportunities for annual earnings in departments operated the equivalent of nine full months and over during 1910.

Table B shows the opportunities for annual earnings in departments operated the equivalent of six full months and less than nine full months during 1910.

Table C shows the opportunities for annual earnings in departments operated the equivalent of three full months and less than six full months during 1910.

The opportunities for annual earnings in the few mills operating the equivalent of less than three full months are not considered.

For discussion of these tables, see page 218.

TABLE A.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 9 MONTHS AND OVER DURING 1910, BY DISTRICTS.

ALL DEPARTMENTS.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	15	93	130	16	199	453	1.0	0.7	0.4	0.1	3.5	0.6
$300 and under $325	....	43	145	73	76	337	....	.3	.4	.3	1.3	.5
$325 and under $350	57	163	126	81	186	613	3.9	1.3	.4	.4	3.3	.8
$350 and under $375	39	306	312	58	402	1,117	2.7	2.4	1.0	.3	7.1	1.5
$375 and under $400	40	303	248	121	535	1,247	2.8	2.4	.8	.6	9.4	1.7
$400 and under $425	24	588	400	322	322	1,656	1.7	4.7	1.2	1.5	5.7	2.2
$425 and under $450	52	713	582	239	416	2,002	3.6	5.7	1.8	1.1	7.3	2.7
$450 and under $475	107	475	858	458	384	2,282	7.4	3.8	2.6	2.1	6.8	3.1
$475 and under $500	73	962	1,082	625	323	3,065	5.0	7.6	3.3	2.9	5.7	4.1
$500 and under $525	100	1,185	1,027	843	216	3,371	6.9	9.4	3.1	3.9	3.8	4.6
$525 and under $550	16	743	1,563	883	191	3,396	1.1	5.9	4.8	4.1	3.4	4.6
$550 and under $575	56	548	1,612	1,126	442	3,784	3.9	4.4	4.9	5.2	7.8	5.1
$575 and under $600	86	688	2,094	1,932	199	4,999	5.9	5.5	6.4	9.0	3.5	6.8
$600 and under $650	80	1,221	4,265	2,894	499	8,959	5.5	9.7	13.1	13.4	8.8	12.1
$650 and under $700	149	985	2,814	2,618	278	6,844	10.3	7.8	8.6	12.1	4.9	9.3

TABLE A.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 9 MONTHS AND OVER DURING 1910, BY DISTRICTS—Continued.

ALL DEPARTMENTS—Concluded.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
$700 and under $750	103	686	3,184	2,062	262	6,297	7.1	5.5	9.8	9.6	4.6	8.5
$750 and under $800	108	533	2,133	1,591	120	4,485	7.5	4.2	6.5	7.4	2.1	6.1
$800 and under $900	122	806	2,848	1,562	239	5,577	8.4	6.4	8.7	7.2	4.2	7.5
$900 and under $1,000	57	491	2,101	1,108	123	3,880	3.9	3.9	6.4	5.1	2.2	5.3
$1,000 and under $1,100	41	207	1,406	803	81	2,538	2.8	1.6	4.3	3.7	1.4	3.4
$1,100 and under $1,200	17	260	925	427	44	1,673	1.2	2.1	2.8	2.0	.8	2.3
$1,200 and under $1,400	36	230	1,005	676	56	2,003	2.5	1.8	3.1	3.1	1.0	2.7
$1,400 and under $1,600	40	176	682	314	20	1,232	2.8	1.4	2.1	1.5	.4	1.7
$1,600 and under $1,800	22	82	406	311	35	856	1.5	.7	1.2	1.4	.6	1.2
$1,800 and under $2,000	6	17	220	169	14	426	.4	.1	.7	.8	.2	.6
$2,000 and under $2,250	2	43	127	122	15	309	.1	.3	.4	.6	.3	.4
$2,250 and under $2,500	....	18	96	42	1	157	....	.1	.3	.2	(1)	.2
$2,500 and over	1	17	224	100	4	346	.1	.1	.7	.5	.1	.5
Total	1,449	12,582	32,615	21,576	5,682	73,904	100.0	100.0	100.0	100.0	100.0	100.0

BLAST FURNACES.

Classified annual earnings.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	1	8	4	....	46	59	0.3	0.2	(1)	....	1.1	0.2
$300 and under $325	....	12	9	1	56	78	....	.3	0.1	(1)	1.4	.3
$325 and under $350	....	6	9	....	121	136	....	.2	.1	....	3.0	.5
$350 and under $375	....	45	21	3	344	413	....	1.2	.2	(1)	8.4	1.6
$375 and under $400	....	33	74	2	491	600	....	.8	.8	(1)	12.0	2.4
$400 and under $425	5	132	44	97	291	569	1.4	3.4	.5	1.4	7.1	2.3
$425 and under $450	....	268	235	97	393	993	....	6.9	2.4	1.4	9.6	3.9
$450 and under $475	2	195	229	189	359	974	.5	5.0	2.4	2.6	8.8	3.9
$475 and under $500	33	103	245	190	196	767	8.9	2.6	2.5	2.7	4.8	3.0
$500 and under $525	6	840	266	155	167	1,434	1.6	21.5	2.7	2.2	4.1	5.7
$525 and under $550	1	313	387	90	129	920	.3	8.0	4.0	1.3	3.2	3.6
$550 and under $575	33	205	380	377	265	1,260	8.9	5.2	3.9	5.3	6.5	5.0
$575 and under $600	28	307	419	642	160	1,556	7.6	7.8	4.3	9.0	3.9	6.2
$600 and under $650	39	455	1,556	933	414	3,397	10.6	11.6	16.0	13.0	10.1	13.5
$650 and under $700	82	360	1,233	1,187	140	3,002	22.2	9.2	12.7	16.6	3.4	11.9

$700 and under $750	31	296	1,533	991	169	3,020	8.4	7.6	15.8	13.8	4.1	12.0
$750 and under $800	39	87	846	717	102	1,791	10.6	2.2	8.7	10.0	2.5	7.1
$800 and under $900	33	161	1,124	633	105	2,056	8.9	4.1	11.6	8.8	2.6	8.1
$900 and under $1,000	9	45	509	336	60	959	2.4	1.2	5.2	4.7	1.5	3.8
$1,000 and under $1,100	17	18	302	255	32	624	4.6	.5	3.1	3.6	.8	2.5
$1,100 and under $1,200	6	6	152	133	17	314	1.6	.2	1.6	1.9	.4	1.2
$1,200 and under $1,400	1	15	118	102	25	261	.3	.4	1.2	1.4	.6	1.0
$1,400 and under $1,600	1	1	30	18	3	53	.3	(1)	.3	.3	.1	.2
$1,600 and under $1,800	2	1		4	1	8	.5	(1)		.1	(1)	(1)
$1,800 and under $2,000			2	4	1	7			(1)	.1	(1)	(1)
$2,000 and under $2,250					1	1					(1)	(1)
$2,250 and under $2,500				1		1				(1)		(1)
Total	369	3,912	9,727	7,157	4,088	25,253	100.0	100.0	100.0	100.0	100.0	100.0

BESSEMER CONVERTERS.

Under $300												
$300 and under $325		7	25			32		1.4	1.0			0.8
$325 and under $350			29			29			1.2			.7
$350 and under $375			5	1		6			.2	0.1		.1
$375 and under $400			9	2		11			.4	.2		.3
$400 and under $425			11			11			.4			.3
$425 and under $450		2	6	4		12		.4	.2	.3		.3
$450 and under $475			22	4		26			.9	.3		.6
$475 and under $500		206	101	26		333		42.0	4.0	2.1		7.8
$500 and under $525		60	56	11		127		12.2	2.2	.9		3.0
$525 and under $550			77	6		83			3.1	.5		2.0
$550 and under $575		5	66	17		88		1.0	2.6	1.3		2.1
$575 and under $600		15	222	289		526		3.1	8.9	22.9		12.4
$600 and under $650		59	328	206		593		12.0	13.1	16.3		14.0
$650 and under $700		42	247	148		437		8.6	9.9	11.7		10.3
$700 and under $750		29	306	144		479		5.9	12.3	11.4		11.3
$750 and under $800		6	215	71		292		1.2	8.6	5.6		6.9
$800 and under $900		13	236	102		351		2.7	9.5	8.1		8.3
$900 and under $1,000		23	174	41		238		4.7	7.0	3.2		5.6
$1,000 and under $1,100		13	87	35		135		2.7	3.5	2.8		3.2
$1,100 and under $1,200			98	23		121			3.9	1.8		2.8
$1,200 and under $1,400		6	97	31		134		1.2	3.9	2.5		3.2
$1,400 and under $1,600		4	36	17		57		.8	1.4	1.3		1.3
$1,600 and under $1,800			32	29		61			1.3	2.3		1.4
$1,800 and under $2,000			4	22		26			.2	1.7		.6
$2,000 and under $2,250			6	13		19			.2	1.0		.4
$2,250 and under $2,500				10		10				.8		.2
$2,500 and over				12		12				.9		.3
Total		490	2,495	1,264		4,249		100.0	100.0	100.0		100.0

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[1] Less than one-tenth of 1 per cent.

TABLE A.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 9 MONTHS AND OVER DURING 1910, BY DISTRICTS—Continued.

OPEN-HEARTH FURNACES.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	....	5	14	1	....	20	....	0.2	0.3	(1)	....	0.2
$300 and under $325	....	4	55	24	....	83	....	.1	1.0	0.7	....	.7
$325 and under $350	....	44	33	35	4	116	....	1.6	.6	1.0	0.9	.9
$350 and under $375	....	14	63	2	9	88	....	.5	1.1	.1	2.1	.7
$375 and under $400	....	12	41	17	....	70	....	.4	.7	.5	....	.6
$400 and under $425	....	65	27	6	2	100	....	2.3	.5	.2	.5	.8
$425 and under $450	....	224	4	8	....	236	....	8.1	.1	.2	....	1.9
$450 and under $475	55	98	32	4	5	194	45.8	3.5	.6	.1	1.2	1.6
$475 and under $500	1	152	33	21	40	247	.8	5.5	.6	.6	9.4	2.0
$500 and under $525	....	73	77	123	21	294	....	2.6	1.4	3.7	4.9	2.4
$525 and under $550	10	190	316	99	....	615	8.3	6.8	5.7	3.0	....	5.0
$550 and under $575	1	106	234	30	24	395	.8	3.8	4.2	.9	5.6	3.2
$575 and under $600	1	160	386	115	....	662	.8	5.8	6.9	3.4	....	5.4
$600 and under $650	10	355	846	503	32	1,746	8.3	12.8	15.2	15.0	7.5	14.3
$650 and under $700	15	249	354	489	88	1,195	12.5	9.0	6.4	14.6	20.7	9.8
$700 and under $750	5	158	514	342	32	1,051	4.2	5.7	9.2	10.2	7.5	8.6
$750 and under $800	....	148	429	258	5	840	....	5.3	7.7	7.7	1.2	6.9
$800 and under $900	5	275	414	260	69	1,023	4.2	9.9	7.4	7.8	16.2	8.4
$900 and under $1,000	2	186	456	254	14	912	1.7	6.7	8.2	7.6	3.3	7.4
$1,000 and under $1,100	7	43	335	199	31	615	5.8	1.5	6.0	5.9	7.3	5.0
$1,100 and under $1,200	2	93	241	68	7	411	1.7	3.3	4.3	2.0	1.6	3.4
$1,200 and under $1,400	4	59	163	213	14	453	3.3	2.1	2.9	6.4	3.3	3.7
$1,400 and under $1,600	....	35	243	96	2	376	....	1.3	4.4	2.9	.5	3.1
$1,600 and under $1,800	....	7	135	93	25	260	....	.3	2.4	2.8	5.9	2.1
$1,800 and under $2,000	2	4	59	32	....	97	1.7	.1	1.1	1.0	....	.8
$2,000 and under $2,250	....	12	5	37	2	56	....	.4	.1	1.1	.5	.5
$2,250 and under $2,500	....	7	12	1	....	20	....	.3	.2	(1)	....	.2
$2,500 and over	....	2	46	21	....	69	....	.1	.8	.6	....	.6
Total	120	2,780	5,567	3,351	426	12,244	100.0	100.0	100.0	100.0	100.0	100.0

MECHANICAL ROLLING MILLS.

Under $300	....	47	36	10	10	103	....	1.4	0.5	0.2	1.4	0.6
$300 and under $325	....	12	25	18	8	63	....	.3	.3	.3	1.1	.3
$325 and under $350	....	81	42	12	2	137	....	2.4	.5	.2	.3	.7
$350 and under $375	....	75	52	25	30	182	....	2.2	.7	.4	4.2	1.0
$375 and under $400	....	173	46	28	28	275	....	5.0	.6	.4	3.9	1.5
$400 and under $425	....	142	104	128	6	380	....	4.1	1.3	2.0	.8	2.0
$425 and under $450	....	128	91	36	5	260	....	3.7	1.1	.6	.7	1.4
$450 and under $475	11	132	88	144	10	385	6.2	3.8	1.1	2.3	1.4	2.1
$475 and under $500	12	444	358	185	74	1,073	6.7	12.9	4.5	2.9	10.4	5.7
$500 and under $525	12	143	306	259	23	743	6.7	4.2	3.8	4.1	3.2	4.0
$525 and under $550	4	174	432	420	49	1,079	2.2	5.1	5.4	6.6	6.9	5.8
$550 and under $575	16	176	616	513	139	1,460	9.0	5.1	7.7	8.1	19.5	7.8
$575 and under $600	2	149	566	667	35	1,419	1.1	4.3	7.1	10.5	4.9	7.6
$600 and under $650	17	214	927	947	29	2,134	9.6	6.2	11.6	14.9	4.1	11.4
$650 and under $700	17	232	522	600	45	1,416	9.6	6.7	6.5	9.4	6.3	7.6
$700 and under $750	15	103	528	458	58	1,162	8.4	3.0	6.6	7.2	8.1	6.2
$750 and under $800	21	208	401	425	13	1,068	11.8	6.0	5.0	6.7	1.8	5.7
$800 and under $900	15	280	693	349	33	1,370	8.4	8.1	8.7	5.5	4.6	7.3
$900 and under $1,000	17	123	570	292	41	1,043	9.6	3.6	7.1	4.6	5.7	5.6
$1,000 and under $1,100	8	80	422	215	14	739	4.5	2.3	5.3	3.4	2.0	4.0
$1,100 and under $1,200	7	111	238	110	16	482	3.9	3.2	3.0	1.7	2.2	2.6
$1,200 and under $1,400	2	69	370	121	14	576	1.1	2.0	4.6	1.9	2.0	3.1
$1,400 and under $1,600	....	90	197	133	8	428	....	2.6	2.5	2.1	1.1	2.3
$1,600 and under $1,800	2	29	107	138	1	277	1.1	.8	1.3	2.2	.1	1.5
$1,800 and under $2,000	....	3	87	70	13	173	....	.1	1.1	1.1	1.8	.9
$2,000 and under $2,250	....	23	63	87	9	132	....	.7	.8	.6	1.3	.7
$2,250 and under $2,500	....	1	47	10	....	58	....	(1)	.6	.2	....	.3
$2,500 and over	....	2	49	17	1	69	....	.1	.6	.3	.1	.4
Total	178	3,444	7,983	6,367	714	18,686	100.0	100.0	100.0	100.0	100.0	100.0

HAND ROLLING MILLS.

Under $300	14	33	76	5	143	271	1.8	1.7	1.1	0.1	31.5	2.0
$300 and under $325	....	8	31	30	12	81	....	.4	.5	.9	2.6	.6
$325 and under $350	57	32	13	34	59	195	7.3	1.6	.2	1.0	13.0	1.4
$350 and under $375	39	172	171	27	19	428	5.0	8.8	2.5	.8	4.2	3.2
$375 and under $400	40	85	78	72	16	291	5.1	4.3	1.1	2.1	3.5	2.2
$400 and under $425	19	249	214	91	23	596	2.4	12.7	3.1	2.6	5.1	4.4
$425 and under $450	52	91	246	94	18	501	6.6	4.7	3.6	2.7	4.0	3.7
$450 and under $475	39	50	487	117	10	703	5.0	2.6	7.1	3.4	2.2	5.2
$475 and under $500	27	57	345	203	13	645	3.5	2.9	5.0	5.9	2.9	4.8
$500 and under $525	82	69	322	295	5	773	10.5	3.5	4.7	8.6	1.1	5.7
$525 and under $550	1	66	351	268	13	699	.1	3.4	5.1	7.8	2.9	5.2

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[1] Less than one-tenth of 1 per cent.

TABLE A.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 9 MONTHS AND OVER DURING 1910, BY DISTRICTS—Concluded.

HAND ROLLING MILLS—Concluded.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	uther district.	Total, all districts.	4 New England district.	Eastern district.	Pitts-burgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
$550 and under $575	6	56	316	189	14	581	.8	2.9	4.6	5.5	3.1	4.3
$575 and under $600	55	57	501	219	4	836	7.0	2.9	7.3	6.4	.9	6.2
$600 and under $650	14	138	608	305	24	1,089	1.8	7.1	8.9	8.9	5.3	8.1
$650 and under $700	35	102	458	194	5	794	4.5	5.2	6.7	5.6	1.1	5.9
$700 and under $750	52	100	303	127	3	585	6.6	5.1	4.4	3.7	.7	4.3
$750 and under $800	48	84	242	120	...	494	6.1	4.3	3.5	3.5	...	3.7
$800 and under $900	69	77	381	218	32	777	8.8	3.9	5.6	6.3	7.0	5.8
$900 and under $1,000	29	114	392	185	8	728	3.7	5.8	5.7	5.4	1.8	5.4
$1,000 and under $1,100	9	53	260	99	4	425	1.2	2.7	3.8	2.9	.9	3.2
$1,100 and under $1,200	2	50	196	93	4	345	.3	2.6	2.9	2.7	.9	2.6
$1,200 and under $1,400	29	81	257	209	3	579	3.7	4.1	3.8	6.1	.7	4.3
$1,400 and under $1,600	39	46	176	50	7	318	5.0	2.4	2.6	1.5	1.5	2.4
$1,600 and under $1,800	18	45	132	47	8	250	2.3	2.3	1.9	1.4	1.8	1.9
$1,800 and under $2,000	4	10	68	41	...	123	.5	.5	1.0	1.2	...	.9
$2,000 and under $2,250	2	8	53	35	3	101	.3	.4	.8	1.0	.7	.7
$2,250 and under $2,500	...	10	37	20	1	68	...	.5	.5	.6	.2	.5
$2,500 and over	1	13	129	50	3	196	.1	.7	1.9	1.5	.7	1.5
Total	782	1,956	6,843	3,437	454	13,472	100.0	100.0	100.0	100.0	100.0	100.0

TABLE B.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 6 AND UNDER 9 MONTHS DURING 1910, BY DISTRICTS.

ALL DEPARTMENTS.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	3	182	280	107	378	960	1.1	7.2	5.4	3.2	26.9	7.5
$300 and under $325	30	194	194	114	101	633	10.9	7.7	3.8	3.4	7.2	5.0
$325 and under $350	20	205	248	159	179	811	7.3	8.1	4.8	4.8	12.7	6.4
$350 and under $375	21	304	209	423	75	1,032	7.7	12.0	4.1	12.7	5.3	8.1
$375 and under $400	24	197	399	253	109	982	8.8	7.8	7.7	7.6	7.7	7.7
$400 and under $425	11	206	295	235	98	845	4.0	8.1	5.7	7.1	7.0	6.7
$425 and under $450	31	158	451	322	104	1,066	11.3	6.2	8.7	9.7	7.4	8.4
$450 and under $475	18	158	380	344	53	953	6.6	6.2	7.4	10.4	3.8	7.5
$475 and under $500	12	95	268	213	46	624	4.4	3.8	5.0	6.4	3.3	4.9
$500 and under $525	4	185	326	89	61	665	1.5	7.3	6.3	2.7	4.3	5.2
$525 and under $550	7	87	313	134	26	567	2.6	3.4	6.1	4.0	1.8	4.5
$550 and under $575	2	50	231	124	21	428	.7	2.0	4.5	3.7	1.5	3.4
$575 and under $600	7	68	135	92	13	315	2.6	2.7	2.6	2.8	.9	2.5
$600 and under $650	4	100	222	141	14	481	1.5	4.0	4.3	4.2	1.0	3.8
$650 and under $700	34	54	179	120	52	439	12.4	2.1	3.5	3.6	3.7	3.5
$700 and under $750	7	64	113	77	12	273	2.6	2.5	2.2	2.3	.9	2.2
$750 and under $800	5	27	91	81	6	210	1.8	1.1	1.8	2.4	.4	1.7
$800 and under $900	2	65	206	68	21	362	.7	2.6	4.0	2.0	1.5	2.9
$900 and under $1,000	11	44	106	60	11	232	4.0	1.7	2.1	1.8	.8	1.8
$1,000 and under $1,100	1	11	118	47	7	184	.4	.4	2.3	1.4	.5	1.5
$1,100 and under $1,200	2	17	102	23	4	148	.7	.7	2.0	.7	.3	1.2
$1,200 and under $1,400	10	20	142	40	6	218	3.6	.8	2.8	1.2	.4	1.7
$1,400 and under $1,600	....	16	78	20	4	118	....	.6	1.5	.6	.3	.9
$1,600 and under $1,800	5	10	21	18	....	54	1.8	.4	.4	.5	....	.4
$1,800 and under $2,000	....	5	14	7	1	27	....	.2	.3	.2	.1	.2
$2,000 and under $2,250	3	4	14	4	2	27	1.1	.2	.3	.1	.1	.2
$2,250 and under $2,500	....	2	5	....	....	7	....	.1	.1	....	....	.1
$2,500 and over	....	2	27	3	3	35	....	.1	.5	.1	.2	.3
Total	274	2,530	5,157	3,318	1,407	12,686	100.0	100.0	100.0	100.0	100.0	100.0

TABLE B.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 6 AND UNDER 9 MONTHS DURING 1910, BY DISTRICTS—Continued.

BLAST FURNACES.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	....	29	87	4	184	304	....	3.7	9.3	0.5	22.7	8.9
$300 and under $325	....	108	47	24	90	269	....	13.8	5.0	2.7	11.1	7.9
$325 and under $350	....	87	17	5	142	251	....	11.1	1.8	.6	17.5	7.4
$350 and under $375	....	57	12	109	67	245	....	7.3	1.3	12.3	8.3	7.2
$375 and under $400	....	65	34	83	80	262	....	8.3	3.6	9.4	9.9	7.7
$400 and under $425	....	36	44	30	52	162	....	4.6	4.7	3.4	6.4	4.7
$425 and under $450	....	73	79	135	67	354	....	9.3	8.4	15.3	8.3	10.4
$450 and under $475	....	73	118	153	33	377	....	9.3	12.6	17.3	4.1	11.0
$475 and under $500	....	38	16	79	30	163	....	4.9	1.7	8.9	3.7	4.8
$500 and under $525	....	86	166	20	18	290	....	11.0	17.7	2.3	2.2	8.5
$525 and under $550	....	36	102	69	8	215	....	4.6	10.9	7.8	1.0	6.3
$550 and under $575	....	19	60	80	14	173	....	2.4	6.4	9.0	1.7	5.1
$575 and under $600	....	22	33	21	4	80	....	2.8	3.5	2.4	.5	2.3
$600 and under $650	....	17	39	26	12	94	....	2.2	4.2	2.9	1.5	2.8
$650 and under $700	....	19	24	26	4	73	....	2.4	2.6	2.9	.5	2.1
$700 and under $750	....	10	15	9	4	38	....	1.3	1.6	1.0	.5	1.1
$750 and under $800	....	3	16	4	....	23	....	.4	1.7	.5	....	.7
$800 and under $900	....	2	20	4	1	27	....	.3	2.1	.5	.1	.8
$900 and under $1,000	....	1	7	2	1	11	....	.1	.7	.2	.1	.3
$1,000 and under $1,100	....	....	1	2	....	3	....	....	.1	.2	....	.1
Total	....	781	937	885	811	3,414	....	100.0	100.0	100.0	100.0	100.0

BESSEMER CONVERTERS.

Classified annual earnings.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	....	....	4	1	74	79	....	....	0.8	0.3	34.3	7.3
$300 and under $325	....	....	....	35	6	41	....	....	....	9.5	2.8	3.8
$325 and under $350	....	....	2	78	7	87	....	....	.4	21.1	3.2	8.1
$350 and under $375	....	....	10	22	2	34	....	....	2.0	6.0	.9	3.2
$375 and under $400	....	....	....	23	20	43	....	....	....	6.2	9.3	4.0
$400 and under $425	....	....	18	16	....	34	....	....	3.7	4.3	....	3.2
$425 and under $450	....	....	45	6	10	61	....	....	9.1	1.6	4.6	5.7
$450 and under $475	....	....	31	60	6	97	....	....	6.3	16.3	2.8	9.0

$475 and under $500	....	....	88	21	9	118	....	....	17.8	5.7	4.2	10.9
$500 and under $525	....	....	62	14	40	116	....	....	12.6	3.8	18.5	10.8
$525 and under $550	....	....	45	10	3	58	....	....	9.1	2.7	1.4	5.4
$550 and under $575	....	....	47	2	1	50	....	....	9.5	.5	.5	4.6
$575 and under $600	....	....	18	6	4	28	....	....	3.7	1.6	1.9	2.6
$600 and under $650	....	....	18	23	....	41	....	....	3.7	6.2	....	3.8
$650 and under $700	....	....	20	4	19	43	....	....	4.1	1.1	8.8	4.0
$700 and under $750	....	....	14	24	5	43	....	....	2.8	6.5	2.3	4.0
$750 and under $800	....	....	14	6	....	20	....	....	2.8	1.6	....	1.9
$800 and under $900	....	....	3	6	1	10	....	....	.6	1.6	.5	.9
$900 and under $1,000	....	....	10	8	5	23	....	....	2.0	2.2	2.3	2.1
$1,000 and under $1,100	....	....	2	4	2	8	....	....	.4	1.1	.9	.7
$1,100 and under $1,200	....	....	3	....	....	3	....	....	.6	....	....	.3
$1,200 and under $1,400	....	....	24	....	2	26	....	....	4.9	....	.9	2.4
$1,400 and under $1,600	....	....	15	....	....	15	....	....	3.0	....	....	1.4
Total	....	....	493	369	216	1,078	....	....	100.0	100.0	100.0	100.0

OPEN-HEARTH FURNACES.

Under $300	....	41	22	....	....	63	....	10.3	4.4	....	....	5.5
$300 and under $325	....	4	2	....	....	6	....	1.0	.4	....	....	.5
$325 and under $350	14	7	26	8	....	55	11.4	1.8	5.2	10.1	....	4.8
$350 and under $375	....	131	7	....	....	138	....	33.0	1.4	....	....	12.1
$375 and under $400	6	65	7	26	....	104	4.9	16.4	1.4	32.9	....	9.1
$400 and under $425	7	17	28	5	....	57	5.7	4.3	5.6	6.3	....	5.0
$425 and under $450	28	8	73	8	18	135	22.8	2.0	14.7	10.1	45.0	11.9
$450 and under $475	5	5	29	3	12	54	4.1	1.3	5.8	3.8	30.0	4.7
$475 and under $500	6	16	76	....	....	98	4.9	4.0	15.3	....	....	8.6
$500 and under $525	4	33	16	5	....	58	3.3	8.3	3.2	6.3	....	5.1
$525 and under $550	6	10	26	6	....	48	4.9	2.5	5.2	7.6	....	4.2
$550 and under $575	2	3	15	3	....	23	1.6	.8	3.0	3.8	....	2.0
$575 and under $600	6	15	16	1	....	38	4.9	3.8	3.2	1.3	....	3.3
$600 and under $650	....	8	36	5	....	49	....	2.0	7.2	6.3	....	4.3
$650 and under $700	25	....	25	2	2	54	20.3	....	5.0	2.5	5.0	4.7
$700 and under $750	2	6	15	....	....	23	1.6	1.5	3.0	....	....	2.0
$750 and under $800	2	4	14	....	....	20	1.6	1.0	2.8	....	....	1.8
$800 and under $900	2	10	31	2	....	45	1.6	2.5	6.2	2.5	....	4.0
$900 and under $1,000	4	7	....	....	....	11	3.3	1.8	....	....	....	1.0
$1,000 and under $1,100	....	5	4	3	2	14	....	1.3	.8	3.8	5.0	1.2
$1,100 and under $1,200	....	....	4	....	....	4	....	....	.8	....	....	.4
$1,200 and under $1,400	2	1	20	2	2	27	1.6	.3	4.0	2.5	5.0	2.4
$1,400 and under $1,600	....	....	....	....	4	4	....	....	....	....	10.0	.4
$1,600 and under $1,800	....	1	2	....	....	3	....	.3	.4	....	....	.3
$1,800 and under $2,000	....	....	....	....	....	....	....	....	....	....	....	....
$2,000 and under $2,250	2	....	....	....	....	2	1.6	....	....	....	....	.2
$2,250 and under $2,500	....	....	2	....	....	2	....	....	.4	....	....	.2
$2,500 and over	....	....	2	....	....	2	....	....	.4	....	....	.2
Total	123	397	498	79	40	1,137	100.0	100.0	100.0	100.0	100.0	100.0

TABLE B.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 6 AND UNDER 9 MONTHS DURING 1910, BY DISTRICTS—Concluded.

MECHANICAL ROLLING MILLS.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	....	49	63	12	4	128	....	9.7	5.1	1.1	9.8	4.4
$300 and under $325	....	58	14	24	....	96	....	11.5	1.1	2.2	....	3.3
$325 and under $350	....	40	54	34	....	128	....	7.9	4.3	3.1	....	4.4
$350 and under $375	....	50	70	231	4	355	....	9.9	5.6	21.0	9.8	12.3
$375 and under $400	....	38	174	62	....	274	....	7.5	14.0	5.6	....	9.5
$400 and under $425	....	31	76	137	....	244	....	6.1	6.1	12.4	....	8.4
$425 and under $450	....	25	98	48	....	171	....	5.0	7.9	4.4	....	5.9
$450 and under $475	....	34	97	98	....	229	....	6.7	7.8	8.9	....	7.9
$475 and under $500	....	14	36	67	....	117	....	2.8	2.9	6.1	....	4.0
$500 and under $525	....	16	26	30	....	72	....	3.2	2.1	2.7	....	2.5
$525 and under $550	....	6	83	31	10	130	....	1.2	6.7	2.8	24.4	4.5
$550 and under $575	....	7	37	30	....	74	....	1.4	3.0	2.7	....	2.6
$575 and under $600	....	15	38	43	....	96	....	3.0	3.0	3.9	....	3.3
$600 and under $650	....	26	50	43	2	121	....	5.1	4.0	3.9	4.9	4.2
$650 and under $700	....	14	48	57	15	134	....	2.8	3.8	5.2	36.6	4.6
$700 and under $750	....	14	33	30	....	77	....	2.8	2.6	2.7	....	2.7
$750 and under $800	....	8	15	37	2	62	....	1.6	1.2	3.4	4.9	2.1
$800 and under $900	....	15	71	13	....	99	....	3.0	5.7	1.2	....	3.4
$900 and under $1,000	....	17	48	15	....	80	....	3.4	3.8	1.4	....	2.8
$1,000 and under $1,100	....	2	36	13	2	53	....	.4	2.9	1.2	4.9	1.8
$1,100 and under $1,200	....	14	23	12	2	51	....	2.8	1.8	1.1	4.9	1.8
$1,200 and under $1,400	....	3	34	10	....	47	....	.6	2.7	.9	....	1.6
$1,400 and under $1,600	....	4	6	10	....	20	....	.8	.5	.9	....	.7
$1,600 and under $1,800	....	1	3	6	....	10	....	.2	.2	.5	....	.3
$1,800 and under $2,000	....	2	8	6	....	16	....	.4	.6	.5	....	.6
$2,000 and under $2,250	....	....	....	2	....	2	....	....	....	.2	....	.1
$2,250 and under $2,500	....	2	....	....	....	2	....	.4	....	....	....	.1
$2,500 and over	....	....	6	....	....	6	....	....	.5	....	....	.2
Total	....	505	1,247	1,101	41	2,894	....	100.0	100.0	100.0	100.0	100.0

HAND ROLLING MILLS.

Under $300	3	63	104	90	116	376	2.0	7.4	5.3	10.2	38.8	9.0
$300 and under $325	30	24	131	31	5	221	19.9	2.8	6.6	3.5	1.7	5.3
$325 and under $350	6	71	149	34	30	290	4.0	8.4	7.5	3.8	10.0	7.0
$350 and under $375	21	66	110	61	2	260	13.9	7.8	5.5	6.9	.7	6.2
$375 and under $400	18	29	184	59	9	299	11.9	3.4	9.3	6.7	3.0	7.2
$400 and under $425	4	122	129	47	46	348	2.6	14.4	6.5	5.3	15.4	8.4
$425 and under $450	3	52	156	125	9	345	2.0	6.1	7.9	14.1	3.0	8.3
$450 and under $475	13	46	105	30	2	196	8.6	5.4	5.3	3.4	.7	4.7
$475 and under $500	6	27	42	46	7	128	4.0	3.2	2.1	5.2	2.3	3.1
$500 and under $525	....	50	56	20	3	129	....	5.9	2.8	2.3	1.0	3.1
$525 and under $550	1	35	57	18	5	116	.7	4.1	2.9	2.0	1.7	2.8
$550 and under $575	....	21	72	9	6	108	....	2.5	3.6	1.0	2.0	2.6
$575 and under $600	1	16	30	21	5	73	.7	1.9	1.5	2.4	1.7	1.8
$600 and under $650	4	49	79	44	....	176	2.6	5.8	4.0	5.0	....	4.2
$650 and under $700	9	21	62	31	12	135	6.0	2.5	3.1	3.5	4.0	3.2
$700 and under $750	5	34	36	14	3	92	3.3	4.0	1.8	1.6	1.0	2.2
$750 and under $800	3	12	32	34	4	85	2.0	1.4	1.6	3.8	1.3	2.0
$800 and under $900	....	38	81	43	19	181	....	4.5	4.1	4.9	6.4	4.3
$900 and under $1,000	7	19	41	35	5	107	4.6	2.2	2.1	4.0	1.7	2.6
$1,000 and under $1,100	1	4	75	25	1	106	.7	.5	3.8	2.8	.3	2.5
$1,100 and under $1,200	2	3	72	11	2	90	1.3	.4	3.6	1.2	.7	2.2
$1,200 and under $1,400	8	16	64	28	2	118	5.3	1.9	3.2	3.2	.7	2.8
$1,400 and under $1,600	....	12	57	10	....	79	....	1.4	2.9	1.1	....	1.9
$1,600 and under $1,800	5	8	16	12	....	41	3.3	.9	.8	1.4	....	1.0
$1,800 and under $2,000	....	3	6	1	1	11	....	.4	.3	.1	.3	.3
$2,000 and under $2,250	1	4	14	2	2	23	.7	.5	.7	.2	.7	.6
$2,250 and under $2,500	....	....	3	....	....	3	....	....	.2	....	....	.1
$2,500 and over	....	2	19	3	3	27	....	.2	1.0	.3	1.0	.6
Total	151	847	1,982	884	299	4,163	100.0	100.0	100.0	100.0	100.0	100.0

TABLE C.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 3 AND UNDER 6 MONTHS DURING 1910, BY DISTRICTS.

ALL DEPARTMENTS.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	14	558	904	363	304	2,143	82.4	79.5	50.8	39.6	51.2	53.5
$300 and under $325	1	34	197	148	66	446	5.9	4.8	11.1	16.2	11.1	11.1
$325 and under $350	1	31	192	99	30	353	5.9	4.4	10.8	10.8	5.1	8.8
$350 and under $375		29	135	53	37	254		4.1	7.6	5.8	6.2	6.3
$375 and under $400		8	56	65	37	166		1.1	3.1	7.1	6.2	4.1
$400 and under $425	1	14	76	39	17	147	5.9	2.0	4.3	4.3	2.9	3.7
$425 and under $450		3	23	26	17	69		.4	1.3	2.8	2.9	1.7
$450 and under $475		2	36	21	9	68		.3	2.0	2.3	1.5	1.7
$475 and under $500		1	6	13		20		.1	.3	1.4		.5
$500 and under $525		1	9	10	22	42		.1	.5	1.1	3.7	1.0
$525 and under $550			21	6	22	49			1.2	.7	3.7	1.2
$550 and under $575		12	6	8	3	29		1.7	.3	.9	.5	.7
$575 and under $600		4	6	19	1	30		.6	.3	2.1	.2	.7
$600 and under $650		2	20	4	11	37		.3	1.1	.4	1.9	.9
$650 and under $700			7	3	2	12			.4	.3	.3	.3
$700 and under $750			65	11		76			3.7	1.2		1.9
$750 and under $800			3		8	11			.2		1.3	.3
$800 and under $900		1	14	12	7	34		.1	.8	1.3	1.2	.8
$900 and under $1,000			2	9		11			.1	1.0		.3
$1,000 and under $1,100		2	1	2	1	6		.3	.1	.2	.2	.1
$1,100 and under $1,200				2		2				.2		(1)
$1,200 and under $1,400			1			1			.1			(1)
$1,400 and under $1,600				3		3				.3		.1
Total	17	702	1,780	916	594	4,009	100.0	100.0	100.0	100.0	100.0	100.0

BLAST FURNACES.

Under $300		329	452	98	143	1,022		81.3	55.6	38.3	53.6	58.8
$300 and under $325		27	62	16	14	119		6.7	7.6	6.3	5.2	6.8
$325 and under $350		17	96	65	22	199		4.3	11.7	25.4	8.2	11.4
$350 and under $375		15	100	32	27	174		3.7	12.3	12.5	10.1	10.0
$375 and under $400			20	29	13	62			2.5	11.3	4.9	3.6
$400 and under $425		2	35	6	2	45		.5	4.3	2.3	.7	2.6
$425 and under $450		2	7		10	19		.5	.9		3.7	1.1
$450 and under $475		2	10	4	6	22		.5	1.2	1.6	2.2	1.3
$475 and under $500			3	2		5			.4	.8		.3
$500 and under $525			5		5	10			.6		1.9	.6
$525 and under $550			2	2	22	26			.2	.8	8.2	1.5
$550 and under $575		8			3	11		2.0			1.1	.6
$575 and under $600			1			1			.1			.1
$600 and under $650			19	1		20			2.3	.4		1.2
$650 and under $700			2	1		3			.2	.4		.2
Total		402	813	256	267	1,738		100.0	100.0	100.0	100.0	100.0

BESSEMER CONVERTERS.

Under $300			109			109			59.6			59.6
$300 and under $325			12			12			6.6			6.6
$325 and under $350			10			10			5.5			5.5
$350 and under $375			11			11			6.0			6.0
$375 and under $400			7			7			3.8			3.8
$400 and under $425			14			14			7.7			7.7
$425 and under $450			3			3			1.6			1.6
$450 and under $475			6			6			3.3			3.3
$475 and under $500			1			1			.5			.5
$500 and under $525			2			2			1.1			1.1
$525 and under $550												
$550 and under $575												
$575 and under $600			4			4			2.2			2.2
$600 and under $650												
$650 and under $700			2			2			1.1			1.1
$700 and under $750			2			2			1.1			1.1
Total			183			183			100.0			100.0

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[1] Less than one-tenth of 1 per cent.

TABLE C.—NUMBER AND PER CENT OF EMPLOYEES HAVING OPPORTUNITY TO EARN EACH CLASSIFIED AMOUNT IN PRODUCING DEPARTMENTS OPERATED 3 AND UNDER 6 MONTHS DURING 1910, BY DISTRICTS—Concluded.

OPEN-HEARTH FURNACES.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300		64		99	87	250		70.3		45.2	44.4	49.4
$300 and under $325		2		71	40	113		2.2		32.4	20.4	22.3
$325 and under $350		10		8	8	26		11.0		3.7	4.1	5.1
$350 and under $375		3		3	4	10		3.3		1.4	2.0	2.0
$375 and under $400		7		10	12	29		7.7		4.6	6.1	5.7
$400 and under $425		2		5	13	20		2.2		2.3	6.6	4.0
$425 and under $450				3		3				1.4		.6
$450 and under $475				4	3	7				1.8	1.5	1.4
$475 and under $500		1				1		1.1				.2
$500 and under $525		1		1	9	11		1.1		.5	4.6	2.2
$525 and under $550				2		2				.9		.4
$550 and under $575				1		1				.5		.2
$575 and under $600				11		11				5.0		2.2
$600 and under $650					6	6					3.1	1.2
$650 and under $700					2	2					1.0	.4
$700 and under $750				1		1				.5		.2
$750 and under $800					8	8					4.1	1.6
$800 and under $900		1			4	5		1.1			2.0	1.0
Total		91		219	196	506		100.0		100.0	100.0	100.0

MECHANICAL ROLLING MILLS.

Classified annual earnings.	Number of employees.						Per cent of employees.					
	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.	New England district.	Eastern district.	Pittsburgh district.	Great Lakes and Middle West district.	Southern district.	Total, all districts.
Under $300	14	36	252	18	74	394	82.4	75.0	46.2	8.8	56.5	41.6
$300 and under $325	1		50	52	12	115	5.9		9.2	25.5	9.2	12.2
$325 and under $350	1	4	74	10		89	5.9	8.3	13.6	4.9		9.4
$350 and under $375		8	16	16	6	46		16.7	2.9	7.8	4.6	4.9
$375 and under $400			20	24	12	56			3.7	11.8	9.2	5.9
$400 and under $425	1		13	15	2	31	5.9		2.4	7.4	1.5	3.3
$425 and under $450			8	14	7	29			1.5	6.9	5.3	3.1
$450 and under $475			16	2		18			2.9	1.0		1.9
$475 and under $500			2	8		10			.4	3.9		1.1

$500 and under $525	....	....	....	5	8	13	....	....	....	2.5	6.1	1.4
$525 and under $550	....	....	8	2	....	10	....	....	1.5	1.0	....	1.1
$550 and under $575	....	....	6	7	....	13	....	....	1.1	3.4	....	1.4
$575 and under $600	....	....	1	4	1	6	....	....	.2	2.0	.8	.6
$600 and under $650	....	....	....	3	5	8	....	....	....	1.5	3.8	.8
$650 and under $700	....	....	....	2	....	2	....	....	....	1.0	....	.2
$700 and under $750	....	....	63	2	....	65	....	....	11.5	1.0	....	6.9
$750 and under $800	....	....	3	....	....	3	....	....	.5	....	....	.3
$800 and under $900	....	....	12	12	3	27	....	....	2.2	5.9	2.3	2.9
$900 and under $1,000	....	....	2	4	....	6	....	....	.4	2.0	....	.6
$1,000 and under $1,100	....	....	....	2	1	3	....	....	....	1.0	.8	.3
$1,100 and under $1,200	....	....	....	2	....	2	....	....	....	1.0	....	.2
Total	17	48	546	204	131	946	100.0	100.0	100.0	100.0	100.0	100.0

HAND ROLLING MILLS.

Under $300	....	129	91	148	....	368	....	80.1	38.2	62.4	....	57.9
$300 and under $325	....	5	73	9	....	87	....	3.1	30.7	3.8	....	13.7
$325 and under $350	....	....	13	16	....	29	....	....	5.5	6.8	....	4.6
$350 and under $375	....	3	8	2	....	13	....	1.9	3.4	.8	....	2.0
$375 and under $400	....	1	9	2	....	12	....	.6	3.8	.8	....	1.9
$400 and under $425	....	10	14	13	....	37	....	6.2	5.9	5.5	....	5.8
$425 and under $450	....	1	5	9	....	15	....	.6	2.1	3.8	....	2.4
$450 and under $475	....	....	4	11	....	15	....	....	1.7	4.6	....	2.4
$475 and under $500	....	....	....	3	....	3	....	....	....	1.3	....	.5
$500 and under $525	....	....	2	4	....	6	....	....	.8	1.7	....	.9
$525 and under $550	....	....	11	....	....	11	....	....	4.6	....	....	1.7
$550 and under $575	....	4	....	....	....	4	....	2.5	....	....	....	.6
$575 and under $600	....	4	....	4	....	8	....	2.5	....	1.7	....	1.3
$600 and under $650	....	2	1	....	....	3	....	1.2	.4	....	....	.5
$650 and under $700	....	....	3	....	....	3	....	....	1.3	....	....	.5
$700 and under $750	....	....	....	8	....	8	....	....	....	3.4	....	1.3
$750 and under $800	....	....	....	....	....	....	....	....	....	....	....	....
$800 and under $900	....	....	2	....	....	2	....	....	.8	....	....	.3
$900 and under $1,000	....	....	....	5	....	5	....	....	....	2.1	....	.8
$1,000 and under $1,100	....	2	1	....	....	3	....	1.2	.4	....	....	.5
$1,100 and under $1,200	....	....	....	....	....	....	....	....	....	....	....	....
$1,200 and under $1,400	....	....	1	....	....	1	....	....	.4	....	....	.2
$1,400 and under $1,600	....	....	....	3	....	3	....	....	....	1.3	....	.5
Total	....	161	238	237	....	636	....	100.0	100.0	100.0	....	100.0

APPENDIX L.—RATES PAID COMMON LABORERS, 1901 TO 1910.

The following table shows for a large number of plants the rates paid common, unskilled laborers during each half year from 1901 to 1910, inclusive. The rate prevailing during the greater part of each half year is given, and, as changes are most frequently made in May and October, they represent the rates prevailing during almost the whole of each half year.

HOURLY RATES OF WAGES PAID COMMON LABORERS IN SPECIFIED PLANTS,[1] BY HALF YEARS, 1901 TO 1910.

EASTERN DISTRICT.

Plant No.	Number of employees [2] in each plant, 1910.	1901		1902		1903		1904		1905		1906		1907		1908		1909		1910	
		First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.
1	2,739	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.145
2	309	.125	.135	.135	.140	.140	.140	.130	.130	.130	.130	.135	.135	.145	.145	.145	.145	.125	.135	.145	.145
3	5,117	.110	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.110	.120	.120	.130
4	63	.115	.115	.125	.125	.135	.125	.120	.120	.125	.125	.125	.125	.150	.150	.125	.125	.125	.120	.135	.135
5	665	.110	.125	.125	.135	.140	.140	.130	.130	.130	.130	.130	.130	.140	.150	.150	.150	.135	140	.150	.150
6	97	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.120	.130	.130	.130	.130	.130	.130	.130
7	295	.125	.125	.125	.130	.130	.130	.125	.125	.125	.135	.135	.135	.150	.150	.130	.125	.125	.130	.150	.150
8	437	.115	.115	.120	.120	.130	.130	.130	.130	.130	.130	.130	.135	.145	.145	.140	.140	.130	.133	.140	.140

PITTSBURGH DISTRICT.

Plant No.	Number of employees [2] in each plant, 1910.	1901		1902		1903		1904		1905		1906		1907		1908		1909		1910	
		First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.	First half.	Second half.
9	122	$0.150	$0.150	$0.150	$0.150	$0.150	$0.150	$0.150	$0.150	$0.150	$0.150	$0.150	$0.150	$0.170	$0.175	$0.175	$0.160	$0.160	$0.160	$0.160	$0.170
10	132	.135	.135	.135	.135	.145	.145	.145	.145	.155	.155	.155	.155	.155	.155	.155	.155	.155	.155	.165	.165
11	356	.150	.150	.165	.165	.165	.165	.165	.165	.165	.165	.165	.165	.165	.165	.160	.160	.160	.160	.160	.170
12	969	.150	.150	.150	.150	.150	.150	.145	.145	.145	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
13	2,953	.140	.140	.140	.150	.150	.150	.140	.140	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
14	1,394	.145	.145	.145	.145	.160	.160	.145	.145	.145	.145	.145	.145	.150	.160	.160	.160	.160	.160	.160	.170
15	4,208	.150	.150	.150	.150	.150	.150	.135	.135	.135	.140	.140	.140	.155	.155	.155	.155	.155	.160	.160	.170
16	956	.135	.145	.145	.145	.145	.145	.135	.135	.135	.145	.145	.145	.155	.155	.155	.155	.155	.160	.160	.170
17	2,693	.125	.125	.125	.125	.125	.125	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.170	.170
18	2,204	.140	.140	.140	.140	.140	.140	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.160	.160
19	810	.140	.140	.140	.140	.140	.140	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150
20	3,850	.145	.145	.145	.145	.145	.145	.140	.140	.140	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.175
21	3,768	.150	.150	.150	.160	.160	.160	.145	.145	.145	.155	.155	.155	.165	.165	.165	.165	.165	.165	.165	.175
	378	.150	.150	.150	.160	.160	.160	.160	.160	.145	.145	.145	.145	.155	.155	.165	.165	.165	.165	.165	.175
22	288	.150	.150	.150	.160	.160	.160	.160	.160	.145	.145	.145	.145	.155	.155	.165	.165	.165	.165	.165	.175
23	4,112	.150	.150	.150	.160	.160	.160	.145	.145	.155	.155	.155	.155	.165	.165	.165	.165	.165	.165	.165	.175

24	6,612	.150	.150	.150	.160	.160	.160	.145	.145	.155	.155	.155	.155	.165	.165	.165	.165	.165	.165	.165	.175
25	1,376	.150	.150	.150	.150	.150	.160	.140	.140	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
26	10,163	[3].135	[3].135	[3].150	[3].150	[3].140	[3].140	[3].140	[3].140	[3].150	[3].150	[3].150	[3].150	[3].150	[3].150	[3].150	[3].150	[3].150	[3].150	[3].150	[3].150
		[4].125	[4].125	[4].135	[4].135	[4].130	[4].130	[4].130	[4].130	[4].135	[4].135	[4].135	[4].135	[4].135	[4].135	[4].135	[4].135	[4].135	[4].140	[4].140	[4].140
		[5].110	[5].110	[5].120	[5].120	[5].120	[5].120	[5].120	[5].120	[5].125	[5].125	[5].125	[5].125	[5].130	[5].130	[5].130	[5].130	[5].130	[5].130	[5].130	[5].130
27	899	.135	.135	.135	.150	.150	.150	.135	.135	.135	.140	.140	.140	.150	.150	.150	.150	.150	.150	.150	.160
28	5,802	.135	.135	.135	.150	.150	.150	.135	.135	.135	.140	.140	.140	.150	.150	.150	.150	.150	.150	.150	.160
29	1,974	.115	.115	.115	.115	.115	.115	.115	.115	.115	.115	.115	.115	.125	.125	.125	.125	.125	.125	.125	.125
30	1,730	.138	.150	.150	.150	.150	.150	.140	.140	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
31	194	.143	.143	.152	.152	.152	.152	.143	.143	.143	.143	.143	.143	.152	.152	.152	.152	.152	.152	.152	.152

GREAT LAKES AND MIDDLE WEST DISTRICT.

32	3,816	$0.155	$0.155	$0.155	$0.165	$0.165	$0.165	$0.145	$0.145	$0.145	$0.150	$0.150	$0.150	$0.160	$0.160	$0.160	$0.160	$0.160	$0.160	$0.160	$0.170
33	2,637	.150	.150	.150	.160	.160	.160	.145	.145	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
34	7,072	.150	.150	.150	.160	.160	.160	.145	.145	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
35	1,400	.140	.140	.140	.140	.140	.140	.140	.140	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.160
36	638	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.150	.160	.160	.170
37	1,025	.130	.130	.130	.130	.130	.140	.140	.140	.140	.140	.140	.140	.150	.150	.150	.150	.150	.150	.150	.155
38	422	.145	.145	.145	.160	.160	.160	.145	.145	.155	.155	.155	.155	.165	.165	.165	.165	.165	.165	.165	.170
39	4,223	.150	.150	.150	.160	.160	.160	.145	.145	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.175
40	1,054	.148	.148	.148	.160	.160	.160	.145	.145	.155	.155	.155	.155	.165	.165	.165	.165	.165	.165	.165	.170
41	703	.148	.148	.148	.148	.148	.148	.145	.145	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
42	247	.148	.148	.148	.148	.148	.148	.145	.145	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
43	299	.148	.148	.148	.148	.148	.148	.145	.145	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170
44	1,181	.140	.150	.150	.160	.160	.160	.145	.145	.150	.150	.150	.150	.160	.160	.160	.160	.160	.160	.160	.170

SOUTHERN DISTRICT.

45	4,061	$0.100	$0.100	$0.110	$0.110	$0.110	$0.110	$0.100	$0.100	$0.100	$0.125	$0.125	[6]$0.140	[6]$0.140	[6]$0.140	$0.125	$0.125	$0.125	$0.125	$0.125	[6]$0.140
46	720	.100	.100	.100	.110	.110	.110	.110	.110	.110	.125	.125	.125	.125	.125	.110	.110	.110	.110	.120	.125
47	362	.110	.110	.125	.125	.125	.125	.125	.125	.110	.125	.140	.140	.140	.140	.140	.140	.140	.140	.140	.140
48	67	.120	.120	.120	.120	.120	.120	.120	.120	.130	.130	.130	.130	.130	.130	.130	.130	.130	.130	.130	.130
49	109	.110	.110	.110	.110	.110	.110	.110	.110	.115	.115	.115	.115	.115	.115	.115	.115	.115	.115	.120	.120

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[1] The plant numbers shown apply only to this table, and can not be used to connect the data given here with data given in other tables in this volume or in Volumes I and II.

[2] Total number of employees and not simply the number of common laborers. The figures are given to show the size of the plant.

[3] Rate paid English-speaking, able-bodied men, such as helpers in mechanical departments.

[4] Rate paid general inside mill labor, able-bodied, best not necessarily English speaking.

[5] Rate paid common labor, non-English speaking, used in railroad department repairs, on excavating work, or as water carriers, etc.

[6] First class labor, $0.15; second class, $0.13.

APPENDIX M.—TONNAGE RATES, AVERAGE EARNINGS, AND OUTPUT OF TONNAGE WORKERS IN REPRESENTATIVE PLANTS, 1900, 1905, AND 1910.

The following table shows for the tonnage workers in each separate occupation the number of employees, hours of labor, tonnage rates, and average earnings per turn in 1900, 1905, and 1910. The average output of the mill in each of these years is also shown. Data for two representative plants are shown for each of the departments. For discussion of this table see page 252.

TONNAGE RATES, AVERAGE EARNINGS, AND OUTPUT OF TONNAGE WORKERS, 1900, 1905, AND 1910.

BESSEMER CONVERTERS: PLANT A.

[Average output in 24 hours: 1900, 3,130 tons=100.0; 1905, 3,310 tons=105.8; 1910, 3,225 tons=103.0.]

Occupation.	1900				1905				1910			
	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.
Regulators, first	2	12	$0.570	$8.95	2	12	[1] $0.460 [2] .380	$7.62	2	12	[1] $0.460 [2] .410	$7.41
Spiegel and manganese men	6	8	.665	6.92	6	8	[1] .490 [2] .405	5.41	6	8	[1] .500 [2] .450	5.36
Vessel men, first	3	8	1.100	11.53	3	8	[1] .840 [2] .690	9.27	3	8	[1] .850 [2] .820	9.14
Vessel men, second	3	8	.860	9.00	3	8	[1] .670 [2] .650	7.30	3	8	[1] .700 [2] .680	7.52
Vessel men, third	3	8	.700	7.32	3	8	[1] .450 [2] .370	4.97	3	8	[1] .500 [2] .490	5.38
Vessel men, fourth	3	8	.620	6.49	3	8	[1] .400 [2] .330	4.42	3	8	[1] .450 [2] .430	4.82
Steel pourers	6	8	.540	5.65	6	8	[1] .470 [2] .390	5.19	6	8	[1] .550 [2] .530	5.91
Ladle cranemen	3	8	.700	7.32	3	8	[1] .500 [2] .410	5.52	3	8	[1] .570 [2] .550	6.12
Stopper setters	12	8	.795	8.32	12	8	[1] .645 [2] .530	7.06	12	8	[1] .650 [2] .625	7.00
Ladle liners and patchers	6	8	.620	6.49	6	8	[1] .450 [2] .370	4.97	6	8	[1] .450 [2] .440	4.85

BESSEMER CONVERTING: PLANT B.

[Average output in 24 hours: 1900, 2,440 tons=100.0; 1905, 2,074 tons=85.0; 1910, 2,100 tons=86.1.]

Regulators, first	2	12	$0.605	$7.38	2	12	$0.40	$4.14	2	12	$0.40	$4.30
Regulators, second	2	12	.605	7.38	2	12	.40	4.14	2	12	.40	4.28
Iron tappers	3	8	.825	6.71	6	12	.33	3.42	6	12	.33	3.58
Iron tappers' helpers	3	8	.792	6.44								
Cinder pitmen	6	8	.605	4.92	6	8	.40	2.76	6	8	.40	2.80
Manganese heaters	2	12	.550	6.70	2	12	.30	3.11	2	12	.30	3.16
Manganese heaters' helpers	2	12	.495	6.04	2	12	.25	2.60	2	12	.25	2.63
Vessel men, second	6	8	.792	6.44	6	8	.60	4.15	6	8	.60	3.98
Steel pourers	3	8	.935	7.60	3	8	.78	5.40	3	8	.78	5.37
Scrap men (vessel)	4	12	.440	5.36	4	12	.30	3.11	4	12	.30	3.16
Stopper setters	3	8	.792	6.44	3	8	.66	4.56	3	8	.66	4.28
Stopper setters' helpers	3	8	.715	5.81	3	8	.60	4.15	3	8	.60	4.13
Mold cappers	3	8	.605	4.92	3	8	.40	2.76	3	8	.40	2.75
Ladle liners	2	12	.550	6.70	2	12	.40	4.14	2	12	.40	4.20
Bottom makers	2	12	.550	6.70	2	12	.35	3.63	2	12	.35	3.67
Bottom makers' helpers	2	12	.495	6.04	2	12	.30	3.11	2	12	.30	3.16

OPEN-HEARTH FURNACES: PLANT A.

[Average output in 24 hours: 1900, 2,450 tons=100.0; 1905, 2,690 tons=109.8; 1910, 2,690 tons=109.8.]

Melters' first helpers	48	12	$8.630	$4.40	48	12	$7.890	$4.40	48	12	$8.310	$4.62
Melters' second helpers	48	12	5.730	2.92	48	12	5.170	2.88	48	12	5.450	3.06
Ladle men	24	12	.950	2.90	24	12	.860	2.89	24	12	.863	2.90
Stopper makers and setters	24	12	.950	2.90	24	12	.800	2.69	24	12	.800	2.69
Pitmen	40	12	.900	2.75	40	12	.710	2.39	48	12	.730	2.45
Narrow-gauge engineers	24	12	.204	2.44	24	12	.198	2.66	24	12	.236	3.17
Ingot strippers	12	12	.440	2.63	10	12	.400	2.69	10	12	.418	2.81

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[1] Rate paid for Bessemer rail ingots. As the output consisted principally of rail ingots, this figure was used in computing the weighted averages.
[2] Rate paid for Bessemer billet ingots.

TONNAGE RATES, AVERAGE EARNINGS, AND OUTPUT OF TONNAGE WORKERS, 1900, 1905, AND 1910—Continued.

OPEN-HEARTH FURNACES: PLANT B.

[Average output in 24 hours: 1900, 375 tons=100.0; 1905, 500 tons=133.3; 1910, 595 tons=158.0.]

Occupation.	1900				1905				1910			
	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.
First helpers,[1] furnaces 1 and 2	4	12	$12.10	$3.92	4	12	$10.50	$3.96	4	12	$10.50	$4.82
First helpers,[1] furnaces 3 to 6	8	12	11.00		8	12	9.50		8	12	9.50	
Second helpers,[1] furnaces 1 and 2	4	12	7.97	2.56	4	12	7.17	2.95	4	12	7.17	3.29
Second helpers,[1] furnaces 3 to 6	8	12	7.15		8	12	6.44		8	12	6.44	
Cinder men	12	12	6.38	2.23	12	12	5.24	2.35	12	12	5.24	2.60
Ladle men	2	12	1.98	3.66	2	12	1.70	4.22	2	12	1.70	5.06
Ladle men's first helper	2	12	1.43	2.65	2	12	1.29	3.20	2	12	1.29	3.84
Ladle men's second helper	2	12	1.32	2.46	2	12	1.19	2.96	2	12	1.19	3.54
Pit boss	2	12	1.43	2.65	2	12	1.25	3.10	2	12	1.25	3.72
Pitmen	2	12	1.32	2.24	2	12	1.19	2.96	2	12	1.19	3.54
Pitmen's first helper	2	12	1.21	2.12	2	12	1.09	2.91	2	12	1.09	3.19
Brakemen	8	12	3.92	1.77	8	12	3.92	1.80	[2] 4	12	1.60	2.34
Chargers	4	12	2.84	2.50	4	12	2.56	3.06	4	12	2.56	2.34
Cranemen	6	12	4.74	2.79	4	12	2.80	3.48	4	12	2.80	4.16

BLOOMING MILL A.

[Average output in 24 hours: 1900, 815 tons=100.0; 1905, 825 tons=101.2; 1910, 1,290 tons=158.3.]

Occupation.	1900				1905				1910			
	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per 100 gross tons per person.	Average earnings per turn per person.
Heaters	3	8	$2.350	$9.59	3	8	$1.40	$5.77	3	8	$1.450	$9.35
Heaters' helpers and bottom makers	9	8	.760	3.09	12	8	.59	2.42	12	8	.610	3.92
Rollers	6	8	1.900	7.75	6	8	1.20	4.96	6	8	1.240	8.00
Tongs men	6	8	.675	2.76	9	8	.55	2.35	9	8	.610	3.94
Shearmen	9	8	.770	3.16	9	8	.65	2.70	6	8	.715	4.61
Shearmen's helpers	6	8	.630	2.57	6	8	.53	2.18	6	8	.550	3.56
Engineers, roll train	3	8	.920	3.75	3	8	.75	3.09	3	8	.775	5.00
Crane and machine operators	15	8	.740	3.02	9	8	.60	2.47	9	8	.620	4.04

BLOOMING MILL B.

[Average output in 24 hours: 1900, 840 tons=100.0; 1905, 820 tons=97.6; 1910, 785 tons=93.5.]

Heaters	2	12	$1.540	$6.51	2	12	$1.320	$5.40	2	12	$1.740	$6.82
Heaters' helpers and bottom makers	8	12	.845	3.57	8	12	.770	3.15	8	12	1.000	3.94
Rollers	2	12	1.540	6.51	2	12	1.320	5.40	2	12	1.740	6.82
Rollers' assistants	6	12	.833	3.52	4	12	.625	2.56	4	12	.825	3.23
Shearmen	2	12	.800	3.38	2	12	.770	3.15	2	12	1.000	3.92
Shearmen's helpers	10	12	.552	2.33	8	12	.528	2.16	8	12	.680	2.67
Engineers, narrow-gauge	4	12	.540	2.28	4	12	.520	2.13	2	12	.780	3.04

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[1] First and second helpers paid on output of individual furnaces. Balance of tonnage men paid on output of entire department.
[2] In 1910, 4 of the 8 brakemen were paid hourly rate.

BAR MILL A.

[Average output in 24 hours: 1900, 108 tons=100.0; 1905, 127 tons=117.6; 1910, 150 tons=138.9]

Occupation.	1900				1905				1910			
	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton per person.	Average earnings per turn. per person.	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton per person.	Average earnings per turn. per person.
Roller [1]	1	12	$0.1955	$21.11	1	12	$0.1760	$22.32	1	12	$0.1760	$24.60
Heaters	2	12	.1000	5.39	2	12	.0900	5.71	2	12	([2])	5.86
Heaters' first helpers	6	12	.0566	3.06	6	12	.0510	3.24	6	12	.0510	3.80
Heaters' second helpers	6	12	.0333	1.80	6	12	.0333	2.11	6	12	.0333	2.50
Chargers	2	12	.0600	3.24	2	12	.0400	2.56	2	12	.0400	2.88
Drag downs	4	12	.0380	2.05	4	12	.0340	2.16	4	12	.0340	2.57
Catchers	2	12	.1000	5.39	2	12	.0775	4.92	2	12	.0775	5.87
Roughers, roller's side	6	12	.0733	3.96	6	12	.0660	4.19	6	12	.0660	4.99
Roughers, catcher's side	6	12	.0720	3.88	6	12	.0650	4.19	6	12	.0650	4.92
First hook, roller's side	2	12	.0475	2.57	2	12	.0466	2.96	2	12	.0466	3.50
Second hook, roller's side	2	12	.0400	2.16	2	12	.0360	2.29	2	12	.0360	2.70
Third hook, roller's side	2	12	.0400	2.16	2	12	.0400	2.54	2	12	.0400	3.00
First hook, catcher's side	2	12	.0420	2.27	2	12	.0400	2.54	2	12	.0400	3.00
Second hook, catcher's side	2	12	.0370	2.00	2	12	.0360	2.29	2	12	.0360	2.70
Third hook, catcher's side	2	12	.0400	2.16	2	12	.0380	2.41	2	12	.0380	2.85
Straighteners	4	12	.0485	2.62	4	12	.0433	2.75	4	12	.0433	3.28
Straightener's helpers	2	12	.0350	1.89	2	12	.0310	1.97	2	12	.0310	2.35
Shearmen	2	12	.0770	4.14	2	12	.0690	4.38	2	12	.0450	3.28
Shearmen's helpers	2	12	.0660	3.55	2	12	.0590	3.74	2	12	.0320	2.30

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[1] Roller paid on entire output of mill, and out of amount shown pays night roller and day and night finishers.
[2] Salary.

TONNAGE RATES, AVERAGE EARNINGS, AND OUTPUT OF TONNAGE WORKERS, 1900, 1905, AND 1910—Cnucluded.

BAR MILL B.

[Average output in 24 hours: 1900, 77 tons=100.0; 1905, 82 tons=106.5; 1910, 106 tons=137.7.]

Occupation.	1900				1905				1910			
	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton. per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton. per person.	Average earnings per turn per person.
Rollers, day [1]	1	12	$0.1270	$9.78	1	12	$0.110	$9.02	1	12	$0.110	$11.68
Rollers, night [2]	1	12	.1790	6.62	1	12	.150	6.08	1	12	.150	8.00
Finishers	2	12	.1130	4.26	2	12	.063	2.56	2	12	.063	3.35
Catchers	2	12	.1360	5.24	2	12	.113	2.21	2	12	.100	5.30
Roughers, down	6	8	.1130	2.90	4	12	.100	4.08	4	12	.090	4.78
Roughers, up	6	8	.0975	2.51	4	12	.088	3.59	4	12	.080	4.25
Hookers	4	12	.0810	3.12	4	12	.054	2.20	4	12	.050	2.65
Heaters	2	12	.0900	3.46	2	12	.090	3.67	2	12	.080	4.25
Heaters' helpers	2	12	(3)	2.16	4	12	.060	2.45	4	12	.055	2.92
Drag downs	2	12	(3)	1.62	4	12	.042	1.72	4	12	.042	2.23
Straighteners	4	12	.0840	3.23	4	12	.075	3.06	4	12	.067	3.52
Shearmen	2	12	.0840	3.23	2	12	.084	3.42	2	12	.065	3.46
Shearmen's helpers	2	12	.0720	2.77	2	12	.072	2.93	2	12	.060	3.18

ROD MILL A.

[Average output in 24 hours: 1900, 282 tons=100.0; 1905, 309 tons=109.6; 1910, 435 tons=154.3.]

Occupation.	1900				1905				1910			
	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton. per person.	Average earnings per turn per person.	Number of employees in 24 hours.	Hours per turn.	Rate per gross ton. per person.	Average earnings per turn per person.
First assistant rollers, day	1	11	$0.0680	$9.57	1	12	$0.0380	$5.76	1	12	$0.0350	$7.68
Second assistant rollers, day	1	11	.0200	2.81	1	12	.0270	4.09	1	12	.0280	6.24
Third assistant rollers, day	....	....	....	....	1	12	.0150	2.32	1	12	.0130	2.76
First assistant rollers, night	1	11	.0680	9.57	1	12	.0430	6.78	1	12	.0360	7.80
Second assistant rollers, night	1	11	.0200	2.81	1	12	.0220	3.47	1	12	.0230	5.04
Third assistant rollers, night	....	....	....	....	1	12	.0150	2.32	1	12	.0130	2.76
Heaters	2	11	.0500	7.03	2	12	.0350	5.40	2	12	.0325	7.32
Heaters' helpers	4	11	.0250	3.51	4	12	.0200	3.09	4	12	.0190	4.08
Roughers	12	11	.0237	3.33	12	12	.0227	3.50	12	12	.0198	4.32
12-inch train men	4	11	.0300	4.20	4	12	.0290	4.48	4	12	.0210	4.56
Diamond pass	4	11	.0330	4.64	4	12	.0310	4.79	4	12	.0300	6.60

First oval pass	4	11	.0300	4.20	4	12	.0290	4.48	4	12	.0260	5.64
Second oval pass	4	11	.0310	4.36	4	12	.0300	4.63	4	12	.0280	6.24
Finishing pass	4	11	.0380	5.34	4	12	.0350	5.40	4	12	.0330	7.32
Hookers, first	2	11	(3)	1.75	2	12	.0120	1.85	2	12	.0120	2.52
Hookers, second	2	11	(3)	1.50	2	12	.0100	1.54	2	12	.0100	2.16
Hookers, third									2	12	.0100	2.04
Laborers[4]	32	11	(3)	1.63	32	12	.0120	1.85	33	12	.0107	2.19

ROD MILL B.

[Average output in 24 hours: 1900, 372 tons=100.0; 1905, 402 tons=108.1; 1910, 470 tons=126.3.]

Assistant rollers	3	12	$0.05400	$10.04	4	12	$0.0450	$9.04	4	12	$0.0460	$10.84
Do	1	12	.06400	11.90								
Heaters	2	12	.05400	10.04	2	12	.0450	9.04	2	12	.0450	10.58
Heaters' helpers	4	12	.02700	5.02	4	12	.0225	4.52	4	12	.0232	5.45
Roughers	4	12	.04150	7.80	4	12	.0360	7.23	6	12	.0247	5.83
Bulldoggers	4	12	.03000	5.64	4	12	.0255	5.12	4	12	.0263	6.19
12-inch train men	4	12	.03600	6.70	4	12	.0320	6.43	4	12	.0330	7.78
Diamond pass	4	12	.03550	6.60	4	12	.0315	6.32	4	12	.0324	7.63
First oval pass	4	12	.03550	6.60	4	12	.0315	6.32	4	12	.0324	7.63
Second oval pass	4	12	.03225	6.10	4	12	.0290	5.82	4	12	.0299	7.04
Roll turners	1	10	.03200	6.06	1	10	.0320	7.42	1	10½	.0330	9.70
Finishing	4	12	.04150	7.80	4	12	.0375	7.53	4	12	.0377	8.88

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[1] Day roller paid on entire output.

[2] Night roller paid on night product.

[3] Day rate.

[4] Includes truckers, conveyor men, billet yardmen, etc.

APPENDIX N.—ANNOUNCEMENT OF UNITED STATES STEEL CORPORATION'S STOCK SUBSCRIPTION PLAN FOR 1912.

UNITED STATES STEEL CORPORATION,
New York, January 2, 1912.

To the officers and employees of the United States
Steel Corporation and of its subsidiary companies.

GENTLEMEN: Annually for the past nine years the corporation has offered to its officers and employees and to the officers and employees of its subsidiary companies the privilege of subscribing for a specified number of shares of its stock under certain terms and conditions. The corporation now offers to such officers and employees the opportunity to subscribe for shares of its preferred or common stock at the price of $110 per share for the former and $65 per share for the latter, subject to the following conditions:

First. All subscriptions shall be made with the express understanding that the decision of the finance committee of the United States Steel Corporation at all times shall be final with respect to the rights or interests of the subscribers, or any question relating to the same.

Second. All subscriptions shall be for one or more shares of preferred or common stock at the subscription price of $110 per share for preferred stock, or $65 per share for common stock, with the understanding that there may be allotted to the subscriber all or any part of his subscription, as such finance committee may determine. No subscription will be received for a combination of both preferred and common stock.

Third. The following table shows the maximum number of shares which may be subscribed for, in accordance with the preceding section, by employees whose salaries or wages are within the respective limits stated, but an employee of any class may subscribe for one or more shares up to the maximum he is entitled to:

SUBSCRIPTIONS TO PREFERRED STOCK.

Employees receiving annual salaries of—	Shares.
$1,100 or less	1
$1,100.01 to $1,833.33	2
$1,833.34 to $3,208.33	3
$3,208.34 to $4,125	4
$4,125.01 to $6,050	5
$6,050.01 to $7,150	6
$7,150. 01 to $8,250	7
$8,250.01 to $9,350	8
$9,350.01 to $13,062.50	9
$13,062.51 to $14,437.50	10
$14,437.51 to $15,812.50	11
$15,812.51 to $17,187.50	12
$17,187.51 to $18,562.50	13
$18,562.51 to $19,937.50	14
$19,937.51 to $34,100	15

SUBSCRIPTIONS TO COMMON STOCK.

Employees receiving annual salaries of—	Shares.
$487.50 or less	1
$487.51 to $1,083.33	2
$1,083,34 to $1,516.66	3
$1,516.67 to $1,950	4
$1,950.01 to $2,383.33	5
$2,383.34 to $3,520.83	6
$3,520.84 to $4,062.50	7
$4,062.51 to $4,604.16	8
$4,604.17 to $6,175	9
$6,175.01 to $6,825	10
$6,825.01 to $7,475	11
$7,475.01 to $8,125	12
$8,125.01 to $8,775	13
$8,775.01 to $9,425	14

SUBSCRIPTIONS TO COMMON STOCK—concluded.

Employees receiving annual salaries of—	Shares.
$9,425.01 to $12,593.75	15
$12,593.76 to $13,406.25	16
$13,406.26 to $14,218.75	17
$14,218.76 to $15,031.25	18
$15,031.26 to $15,843.75	19
$15,843.76 to $16,656.25	20
$16,656.26 to $17,468.75	21
$17,468.76 to $18,281 25	22
$18,281.26 to $19,093.75	23
$19,093.76 to $19,906.25	24
$19,906.26 to $33,150	25

Fourth. Payment of the subscriptions shall be in monthly installments, to be deducted from the salary or wages of the subscriber, in such amounts as he may wish, subject to the provision that the minimum amount of a monthly installment shall be $2.50 per share for preferred stock and $1.50 per share for common stock, and that no installment shall exceed 25 per cent of any one month's salary or wages. It is hoped that subscribers will pay their installments in even dollars, but if more than the minimum is paid it must be in even dollars. The stock must be paid for within three years. Interest at 5 per cent per annum will be charged on deferred payments on the stock.

Fifth. From the date on which payments begin and during the continuation of such payments the dividends paid on the stock will be credited to the account of the subscriber as part of his payments until the stock is fully paid and issued to him, after which dividends will be paid to him as to other stockholders.

Sixth. Subscriptions will be canceled—

(*a*) At the request of the subscriber.

(*b*) By leaving the service or failing to resume employment when requested (see sec. 11).

(*c*) Whenever payments on account of subscription shall have been discontinued without the consent of the corporation for a period of three months.

Thereupon, the subscription and all interest in the stock to which the same relates shall be terminated and there will be returned to the subscriber the exact amount of his payments made on account, with interest at 5 per cent per annum on the same from time of payment, no credit being given him for dividends or for the special allowance referred to in third paragraph of section 7, and no interest being charged on deferred payments.

A subscriber who cancels his subscription must cancel all of it.

Seventh. When the stock is fully paid for, it will be issued in the name of the subscriber. He may sell his certificate whenever he chooses, but as an inducement for him to keep it while he remains in the service the following offer is made, viz:

If he will keep the stock and in January of each year, for five years, commencing with January, 1913, will exhibit the certificate to the treasurer of his company, together with a statement from a proper official that he has been continuously in the employ of the corporation or of one or another of its subsidiary companies during the preceding year, and has shown a proper interest in its welfare and progress, he will for each five years receive a cash payment at the rate of $5 a share for each share of preferred stock, and $3.50 a share for each share of common stock.

Subscribers who may not have fully paid their subscriptions by January in any year, will, if their subscriptions are still in force, and they have otherwise fulfilled all the conditions of continuous and faithful service as provided, be credited in their subscription accounts with the special allowance of $5 per share on their subscriptions for preferred stock, and $3.50 per share on their subscriptions for common stock.

Eighth. If a subscriber keeps his certificate and remains continuously in the service for five years, the corporation intends that he shall then receive a still further compensation, which can not now be ascertained or stated, but which will be derived from the following sources, viz:

The special allowances referred to in section 7 which are forfeited by—

(*a*) Cancellation of subscription;

(*b*) Transfer of certificate from name of subscriber, whether intentionally or otherwise:

(*c*) Leaving the service, or failing to resume employment when requested (see sec. 11)

will be paid by the corporation into a special fund at the end of each year. This fund will be credited with interest at 5 per cent and at the end of the five-years period the total amount thus accumulated will be divided into as many parts as shall be equal to the number of shares of preferred stock plus seven-tenths of the number of shares of common stock then remaining in the hands of subscribers who shall have continued in such employ for the whole five years. The corporation will then by its own final determination award to each subscriber whom it shall find deserving thereof as many parts of such accumulated fund as he shall be entitled to on basis of the number of shares then held by him under this plan, i. e., one part for each share of preferred and seven-tenths of one part for each share of common.

Ninth. In case a subscriber dies or becomes permanently disabled while faithfully serving the corporation or one of its subsidiary companies during such five-year period, payments will be made to his estate or to him as follows:

(*a*) If his subscription is fully paid and he has received and not disposed of his certificate of stock, the corporation will pay, as above stated, a sum equal to $5 or $3.50 per share for each of the five years not then expired, and also a pro rata amount of the special fund arising from forfeitures, referred to in section 8 preceding, which may have accrued at the time of his death or disability.

(*b*) If his subscription has not been paid in full, the corporation will pay, as stated, the money theretofore paid in by him on account, together with the dividends paid on the stock subscribed for, the special compensation for the entire five-year period, and a pro rata share of the amount of the special fund mentioned in paragraph (*a*) preceding, less interest at 5 per cent per annum on deferred installments.

(*c*) If at time of decrease or permanent disablement the subscription has been fully paid but certificate not yet delivered, the corporation will turn over the certificate, as first stated above, together with the additional payments as mentioned in paragraph (*a*) preceding.

A pensioner will not be permitted to subscribe, but any employee who subscribes and is subsequently pensioned will at his request be permitted to pay up his subscription on the same terms as if he had remained in the service, provided, however, that as soon as he shall have fully paid his subscription and received his certificate of stock he will be treated as though permanently disabled, and payments will be made to him in accordance with provisions of paragraph (*a*), section 9.

Tenth. A subscriber may designate in his subscription the person to whom in the event of his death he desires the corporation to pay all amounts in connection with his subscription which would otherwise be payable to his estate. When such designation has been made, the corporation, upon satisfactory proof of death under the conditions of the subscription, will pay to the person designated, if then living, all amounts in connection with the subscription which would otherwise be payable to the estate of the subscriber. When such designation has been made the subscriber's estate shall have no claim to any such amounts unless the person designated should die before the subscriber, and in that event payment will be made to the subscriber's estate. By written notice, delivered to the treasurer of the company by which he is employed, a subscriber may change the person designated.

Eleventh. Subscribing employees whose employment has been or may be suspended by reason of the temporary closing of the plants, and who shall continue ready and willing when required to resume their service, will not be deprived of the special allowance of $5 or $3.50 per share per year during such suspension. This need not interfere with their accepting employment elsewhere during such suspension. As presumptive evidence of such willingness to resume their employment the corporation will accept (1) from the holders of fully paid subscriptions the presentation of the original certificate in January of each year, and (2) from the holders of partly paid subscriptions the retention by them of their subscription during the preceding year.

The above period of suspension will not be counted as part of the three years limited for the full payment of the subscriptions, and during such suspension monthly payments will not be required, though, if so desired by the employee, they may be continued.

Failure to present the original certificate as provided, or the withdrawal of a partly paid subscription, or the failure to resume employment when requested, will constitute a relinquishment of all benefits referred to in this circular.

In case of the death during such suspension of any such subscribing and continuing employee, his estate or his designee, as above, will be entitled to the same benefits accruing to his subscription as if he had died while under employment.

Twelfth. Subscriptions will be received until February 3, 1912, inclusive, and allotment will be made a few days later. The first deductions will be made from February salary or wages.

By order of the finance committee.

UNITED STATES STEEL CORPORATION,
RICHARD TRIMBLE, *Secretary*.

INDEX.

A.

Page.

- Age—
  - Distribution of employees by, in iron and steel industry 96–100
  - Supervisory and clerical employees in a large steel plant in specified age groups, by nativity and conjugal condition 494–496
  - Workmen in a large steel plant, in specified age groups, by departments 99
  - Workmen in a large steel plant, in specified age groups, by skill, nativity, and conjugal condition. 480
  - Workmen in the steel industry, per cent of, in specified age groups, by general nativity and race. 97, 98
- Amalgamated Association of Iron and Steel Workers, history of 110–136
- Amalgamated Association of Iron and Steel Workers, membership and influence of 15
- American Federation of Labor, affidavits presented by, regarding action of United States Steel Corporation during the tin-plate strike of 1909 507–509
- Associated Brotherhood of Iron and Steel Heaters, Rollers, and Roughers 112
- Auxiliary departments of iron and steel mills 74–76

B.

- Bar, hoops, nail plate, etc., production of, 1895 to 1910 35
- Bar mills—
  - Description of 67–72
  - Earnings, hourly, of employees in, classified, 1900, 1905, and 1910 247
  - Earnings, hourly, of employees in, compared for Steel Corporation, large independent companies, and small companies 264
  - Temperature conditions in, and in other small mills 328
  - Tonnage rates, average earnings, and output of tonnage workers in, 1900, 1905, and 1910 579, 580
  - Tonnage rates, relative (1905 and 1910 compared with 1900), of employees in occupations paid less than $3 per turn and in those paid $3 and over per turn in 1900 256
  - Tonnage workers in, relative output, tonnage rates, and earnings of, 1900, 1905, and 1910 254
- Bar, sheet, and billet mills, description of 63, 64
- Bessemer converters—
  - Days in operation, production, average number of employees, and average and relative output per employee per day in, 1890 to 1910 347
  - Earnings, annual, opportunities for, in 222, 225, 561, 566, 567, 571
  - Earnings, hourly, of employees in, classified, 1900, 1905, and 1910 241, 242
  - Earnings, hourly, of employees in, compared for Steel Corporation, large independent companies, and small companies 264
  - Employees earning each classified weekly amount in, by districts 552
  - Intensity of work and actual working time in 351, 352
  - Operating time in, per cent of employees according to 213
  - Overtime work in 196–198
  - Production of steel in, 1865 to 1910 34
  - Productive capacity of a pair of, increase in, 1880 to 1903 301
  - Productive efficiency in, increase in 346–351
  - Productive occupations in, character and severity of work in, 1895 and 1910 512–515
  - Temperature conditions to which workmen are exposed during particular operations in 303
  - Tonnage rates, average earnings, and output of tonnage workers in, 1900, 1905, and 1910 576, 577
  - Tonnage rates, relative (1905 and 1910 compared with 1900), of employees in occupations paid less than $3 per turn and in those paid $3 and over per turn in 1900 256
  - Tonnage workers in, relative output, tonnage rates, and earnings of, 1900, 1905, and 1910 254
  - Weeks of operation of, classified, and number of employees affected 549
- Bessemer department, description of 49, 50
- Bessemer pig iron, billet ingots, rail ingots, and heavy rails, labor cost of, per gross ton, 1902-1906 and 1910 compared 233
- Bessemer pig iron, fluctuations in monthly price of, at Pittsburgh, 1902 to 1911 184
- Bessemer steel ingots and castings, distribution of production of, by States, 1910 477
- Bessemer steel, invention and development of 35–37
- Bessemer steel, production of, 1865 to 1910 34–36
- Billet and sheet bar mills, description of 63, 64
- Billet ingots, Bessemer, labor cost of, per gross ton, 1902–1906 and 1910 compared 233
- Blast furnaces—
  - Age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition 481, 482
  - Bonus plan in 406–408
  - Condition of employees in plants affected by plans for elimination of 7-day work 168–171
  - Days in operation, production, average number of employees, and average and relative output per employee per day in, 1890 to 1910 339
  - Description of 44–48
  - Earnings, annual, opportunities for, in 222, 224, 560, 561, 566, 571
  - Earnings, hourly, of employees in, classified, 1900, 1905, and 1910 239
  - Earnings, hourly, of employees in, compared for Steel Corporation, large independent companies, and small companies 264
  - Eight-hour day, cost of change to, in 177, 178, 183, 184
  - Employees earning each classified weekly amount in, by districts 551

Page.

- Blast furnaces—Concluded.
  - Employees, establishments, capital, and products of, 1899, 1904, and 1909 ... 31
  - Employees in, average number of, each month, 1907 to 1911 ... 208
  - Employees, skilled, semiskilled, and unskilled in, number and per cent of, for a large steel plant. 80
  - English and American conditions in, compared ... 346
  - Fluctuation of employment in, 1907 to 1911 ... 207–210
  - Intensity of work and actual working time in ... 344–346
  - Operating time in, per cent of employees according to ... 213
  - Output, average and relative, per employee in, in specified years, 1869 to 1909 ... 336
  - Overtime work in ... 196–198
  - Productive efficiency in, increases in ... 339–344
  - Productive occupations in, character and severity of work in, 1895 and 1910 ... 510–512
  - Temperature conditions to which workmen are exposed during particular operations in ... 295, 296
  - Weeks of operation of, classified, and number of employees affected ... 548
- Blast furnaces, steel works, and rolling mills—
  - Eight-hour day in, cost of change to ... 179–181, 184–187
  - Temperature conditions in ... 292–333
- Blooming mills—
  - Age, and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition ... 483
  - Description of ... 58–62
  - Earnings, hourly, of employees in, classified, 1900, 1905, and 1910 ... 245, 246
  - Earnings, hourly, of employees in, compared for Steel Corporation, large independent companies, and small companies ... 264
  - Employees, skilled, semiskilled, and unskilled in, and in slabbing mills, number and per cent of, for a large steel plant ... 80
  - Reversing, tests of 38-inch and 40-inch mills, May 12 to 27, 1911 ... 362
  - Temperature conditions in, and in slabbing mills ... 319–325
  - Temperature conditions to which workmen are exposed during particular operations in ... 324
  - Tonnage rates, average earnings, and output of tonnage workers in, 1900, 1905, and 1910 ... 578, 579
  - Tonnage rates, relative (1905 and 1910 compared with 1900), of employees in occupations paid less than $3 per turn and in those paid $3 and over per turn in 1900 ... 256
  - Tonnage workers in, relative output, tonnage rates, and earnings of, 1900, 1905, and 1910 ... 254
- Boiler rooms, stove cleaning, and slag disposal, temperature conditions in ... 300, 301
- Bonus fund in United States Steel Corporation ... 464
- Bonus or compensation contributed by United States Steel Corporation to employees in connection with subscriptions for stock, 1903 to 1911 ... 469
- Bonus plans ... 406–414
- Bosses and foremen, characteristics of ... 82, 83

C.

- Capital invested in blast furnaces and in steel works and rolling mills, 1899, 1904, and 1909 ... 31, 32
- Capitalization, increase in, discussion of ... 31–33
- Capitalization of iron and steel industry ... 14
- Cash checks, or company store orders, payment of wages in ... 392, 393
- Casting crew, blast furnace, temperature conditions of ... 298, 299
- Casting floor, blast furnaces, description of operations on ... 46, 47
- Cinder snappers, per cent of working time of, occupied in hard, medium, and light duties ... 345
- Clerical and supervisory employees of a large representative steel plant, age and years of service in the iron and steel industry, by nativity and conjugal condition ... 494–496
- Commission on Hours of Labor in Continuous Industries, International, resolutions of ... 162–164
- Committee of stockholders of United States Steel Corporation, report of, concerning hours of labor ... 161, 162
- Company houses and company stores ... 399–401, 415–451
- Conditions peculiar to localities and to particular companies ... 26
- Conditions, physical, and efficiency of employees ... 24, 25
- Conjugal condition of employees and size of family ... 102–106
- Consolidation of the industry and its effects on the employment of labor ... 30–33
- Continuous Industries, Report of International Commission on Hours of Labor in ... 162–164
- Continuous-operation agreement of Amalgamated Association of Iron, Steel, and Tin Workers and Western Bar Iron Association, 1910 ... 152, 153
- Continuous operation of steel works, reasons for ... 164–166
- Continuous rod mills, description of ... 73, 74
- Corporation ownership in iron and steel industry ... 14
- Cost of change from 12-hour to 8-hour day ... 17–20, 177–187
- Cost of living and wages ... 23
- Cost of production of finished products, per cent of labor cost of ... 180
- Cost of production per ton, total and for labor, increase in, required in changing from 12-hour to 8-hour system in—
  - Blast furnaces ... 178, 183, 184
  - Blast furnaces, steel works, and rolling mills ... 181, 185
- Cost of production, relation of labor cost to ... 280–286
- Costs and profits, relation of wages to ... 269–286
- Country of birth of employees in a large steel plant, by departments ... 85–87
- Country of birth of employees in a large steel plant, classified according to skill ... 87, 88
- Cranemen, charging, temperature conditions of, in blooming and slabbing mills ... 319, 320
- Crucible steel, production of, 1860 to 1910 ... 34, 35
- Cupola men, Bessemer converters, temperature conditions of ... 304

D.

- Day shift and night shift, number of employees on, in a representative steel plant in Pittsburgh district, working turns of specified hours, July 28 to 30, 1911, by departments ... 533–535
- Deductions for company stores and company houses ... 399–401
- Deductions from wages ... 394–404
- Delays, unusual, distribution of, in 8-inch and 10-inch rolling mills ... 372
- Delays, unusual, distribution of, in 38-inch and 40-inch reversing blooming mills, May 12 to 27, 1911. 362
- Departments, auxiliary, of iron and steel mills ... 74–76
- Departments included in the industry ... 29, 30
- Departments, producing, of iron and steel mills ... 44–74

Page.

- Development of iron and steel industry, history and discussion of 109–111
- Diagram of departments in a large steel works 56
- Disablement funds, deduction from wages for 394–398
- Distribution, geographical, of iron and steel industry 38–40
- Dividends, in per cent of total receipts, paid by Republic Iron & Steel Co., 1906 to 1911 279
- Dividends, in per cent of total receipts, paid by United States Steel Corporation, 1902 to 1911 274
- Docks and blast furnaces, description of 44–48
- Docks, average number of employees, days in operation, tons handled, and average and relative output per employee per day at, 1900 to 1910 341

E.

- Earnings, annual, as affected by irregular employment 215–228
- Earnings, annual, opportunities for 22, 23, 218–228, 559–573
  - Bessemer converters 222, 225, 561, 566, 567, 571
  - Blast furnaces 222, 224, 560, 561, 566, 571
  - Departments operated each classified number of months in 1910 559–573
  - Five principal departments combined 218–221
  - Open-hearth furnaces 222, 225, 226, 562, 567, 572
  - Rolling mills, hand 222, 227, 228, 563, 564, 569, 573
  - Rolling mills, mechanical 222, 227, 563, 568, 572, 573
- Earnings, hourly, average and classified, of laborers in blast furnaces of Pittsburgh district in Steel Corporation, large independent companies, and small companies 267
- Earnings, hourly, average, increase in, required in changing from 12-hour to 8-hour system in—
  - Blast furnaces 178, 183, 184
  - Blast furnaces, steel works, and rolling mills 181, 185
- Earnings, hourly, classified, in 1900, 1905, and 1910—
  - All departments 233, 236
  - Bar mills 247
  - Bessemer converters 241, 242
  - Blast furnaces 239
  - Blooming mills 245, 246
  - Open-hearth furnaces 243
  - Rod mills 248, 249
- Earnings, hourly, of common laborers, 1901 to 1910 .... 251, 252
- Earnings, hourly, of employees of United States Steel Corporation, large independent companies, and small companies in principal producing departments, Pittsburgh district 264
- Earnings of workmen of United States Steel Corporation, large independent companies, and small companies compared 23, 24, 259–267
- Earnings, tonnage rates, and output of tonnage workers in representative plants, 1900, 1905, and 1910 576–581
- Earnings, tonnage rates, and output of tonnage workers, 1900 to 1910 252–258
- Earnings, weekly, all departments and districts combined 217, 218
- Earnings, weekly, classified, of employees in all industries, New Jersey, 1900 and 1910 234
- Earnings, weekly, of employees in iron and steel works, by districts 550–558
- Eastern district, racial distribution of iron and steel employees in 89, 90
- Efficiency and physical conditions of employees 24, 25
- Efficiency and working conditions as affected by heat 287–332
- Efficiency and working conditions as affected by speed and severity of the work 333–367
- Efficiency, productive, increases in—
  - Bessemer converters 346–351
  - Blast furnaces 339–344
  - Open-hearth department 352–354
  - Rolling mills 356–360
  - Tube mills 375, 376
- Efficiency, productive, relation of unsteady employment, shifting character of labor force, low wages, long hours, and night work to 377–384
- Eight-hour system—
  - Actual results of, in a steel foundry 17, 18, 187–192
  - Advantages of 17
  - Cost of change to 17–20, 175–187
- Electric light and power department of a representative steel plant, age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition 488
- Elimination of 7-day week and 12-hour day, plans for 15–20, 157–192, 541–547
- Employees in blast furnaces and in steel works and rolling mills, 1899, 1904, and 1909 .... 31, 32
- Employees in each department of a single large plant, average number of, during each month, 1905 to 1910 .... 210, 211
- Employees in iron and steel industry, number of 14
- Employees. (*See also* Labor force.)
- Employers and workmen, relations of 107–156
- Employment—
  - Bureau of, in a representative plant, operations of 141–144
  - Fluctuation of, in blast furnaces 207–210
  - Fluctuation of, in steel works and rolling mills 210–212
  - Irregularity of 21, 22, 203–228, 379–381
  - Of labor as affected by consolidation of the industry 30–33
  - Of workmen, methods of 140–149
  - Opportunities for, as affected by expansion of industry 31, 32
  - Opportunities for, 1910 212–214
- English, ability of iron and steel employees to speak 93–96
- English and American conditions, compared in—
  - Blast furnaces 346
  - Mechanical rolling mills 362, 363
  - Open-hearth department 355
- Equipment of hand-rolling mills, development of 373–375
- Expansion of industry, effect of, on opportunities for employment 31, 32
- Expense and profits of Republic Iron & Steel Co., 1906 to 1911 278
- Expenses, profits, and receipts of United States Steel Corporation, 1902 to 1911 272
- Experience of immigrants before entering steel industry 100–102
- Extent and organization of the iron and steel industry 27–40

F. Page.

Families of employees, size of 103
Finished products, per cent of labor cost of total cost of production of 180
Finishing mills, description of 57
Food, prices of, relative (weighted), 1900 to 1910 232
Foreign and native born male employees in iron and steel industry, number and per cent of, at specified periods, 1880 to 1908 91
Foreign and native born male employees, per cent of, by principal industries, 1907–8 83
Foreign-born employees in a large steel plant, number and per cent of, who are skilled, semiskilled, and unskilled, by conjugal condition 104
Foreign-born employees in iron and steel industry, per cent of, from each country of birth 92
Foreign-born husbands, per cent of, who reported wife in the United States and who reported wife abroad, by race 103
Foreign-born male employees, per cent of, employed in specified classes of industries before coming to the United States, by race 101, 102
Foreign-born male employees, per cent of, in the United States each specified number of years, by race 93
Foremen and bosses, characteristics of 82, 83
Foremen, petty graft of 147–149
Foundry department of a representative steel plant, age and years of service in iron and steel industry of workmen in, by skill, nativity, and conjugal condition 491
Furnace keepers, per cent of working time of, occupied in hard, medium, and light duties 345

G.

Garret rod mills, description of 72, 73
General and repair departments, list of 30
Geographical distribution of iron and steel industry 38–40
Graft, petty, of foremen 147–149
Guide mills, average daily production and composition of work force in two 8-inch mills, 1900, 1905, and 1910 367

H.

Hand rolling mills. (*See* Rolling mills, hand.)
Handling of material for blast furnaces 44–46
Heat conditions in open-hearth department 53, 54
Heat conditions on casting floor, blast furnaces 47, 48
Heat, records obtained as to character of 292–294
Heat, working conditions and efficiency as affected by 287–332
Heating crew, temperature conditions of, in blooming and slabbing mills 320, 321
Helpers in blast furnaces, per cent of working time of, occupied in hard, medium, and light duties 345
Homestead steel works, strikes in 115, 116
Hot-blast men, per cent of working time of, occupied in hard, medium, and light duties 345
Hour of beginning and hour of quitting work on day and night shifts in a representative steel plant in Pittsburgh district, by departments 536
Hourly earnings. (*See* Earnings.)
Hours of labor in 1912 159–164
Hours of labor in the iron and steel industry—
  Report of committee of stockholder of Steel Corporation concerning 161, 162
  Report of International Commission on Hours of Labor in Continuous Industries 162–164
  Resolutions of finance committee of Steel Corporation regarding 162
Hours worked in a representative steel plant, detailed exhibit of 533–540
Households of each specified number of persons, per cent of, by general nativity and race of head of household 103
Houses, company, general discussion of 418–420
Houses, company, in important steel towns 420–443
Houses, company, in small isolated communities, discussion of 443–445
Housing of Negro workmen maintained by a steel company in the Southern district 435
Housing of officials and skilled workmen by a steel company in the Eastern district 421–423
Housing of white workmen maintained by a steel company in the Southern district 433–435

I.

Immigrants, experience of, before entering steel industry 100–102
Immigrants, utilization of, by American industries 83–90
Independent companies, large and small, earnings of workmen in, compared with those in United States Steel Corporation 259–267
Independent companies, large, present relations of employers and workmen in 138–140
Ingot stripper, description of 54, 55
Ingot strippers, temperature conditions of, in blooming and slabbing mills 323
Ingots, billet and rail, Bessemer, labor cost of, per gross ton, 1902–1906 and 1910 compared 233
International Commission on Hours of Labor in Continuous Industries, report of 162–164
Iron and Steel Heaters, Rollers, and Roughers, Associated Brotherhood of 112
Iron and steel industry and its workmen 14, 15
Iron and steel industry, principal producing centers of 38
Iron and steel production, amount of, by kind of product, 1860 to 1910 34
Iron and steel production, distribution of, by States, 1910 475–478
Iron and Steel Roll Hands of the United States 112
Iron and Steel Workers, Amalgamated Association of 15, 110–136
Iron breakers and carriers, temperature conditions of 299, 300
Iron, rolled, and steel, production of specified articles of, in 1910 38
Iron. (*See* Pig iron.)
Irregularity of employment 21, 22, 203–228

K.

Knights of Labor 113

L.

Page.
Labor conditions as related to localization of the industry ... 39,40
Labor conditions, effects of changes in methods of production on ... 37
Labor cost—
  Cumulative, at works, from receipt of raw material to finished product, 1902 to 1906 ... 281
  Cumulative (both works cost and total cost), compared with average selling price, 1902 to 1906. 285
  Cumulative, total, from extractive processes to finished product, excluding railroad and water transportation, 1902 to 1906 ... 284
  In blast furnaces, per ton of production, and increase in, required in changing from 12-hour to 8-hour system ... 178,183,184
  In blast furnaces, steel works, and rolling mills, per ton of production, and increase in, required in changing from 12-hour to 8-hour system ... 181,185
  Per cent of, of total cost of production of finished products ... 180
  Per gross ton of Bessemer pig iron, billet ingots, rail ingots, and heavy rails, 1902–1906 and 1910, compared ... 233
  Relation of, to total cost of production ... 280
Labor force—
  Age distribution of ... 96–100
  Characteristics of, in a representative steel plant ... 480–496
  Effect of expansion of industry on ... 31,32
  Organization of ... 77–105
  Racial composition of ... 83–93
  Shifting character of, in relation to productive efficiency ... 379–381
  Skilled, semiskilled, and unskilled, in a large steel plant, by departments ... 80–83
Labor organizations prior to formation of the Steel Corporation ... 111–116
Labor organizations under the Steel Corporation, 1902 to 1911 ... 116–136
Laborers, average and classified hourly earnings of, in blast furnaces of Pittsburgh district, in Steel Corporation, large independent companies, and small companies ... 267
Laborers, common, hourly wage rates of, 1901 to 1910 ... 251,252,574,575
Ladle men and platform men, temperature conditions of ... 305,306
Long hours, relation of, to productive efficiency ... 383,384

M.

Manufacturing and operating expenses of Republic Iron & Steel Co., in per cent of total receipts, 1906 to 1911 ... 279
Manufacturing and operating expenses of United States Steel Corporation, in per cent of total receipts, 1902 to 1911 ... 274
Materials, handling of, for blast furnaces ... 44–46
Mechanical and production force, difference in working conditions of ... 79–83
Mechanical department of a representative steel plant, age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition ... 490
Mechanical force, characteristics of ... 82
Mechanical force in steel mills, discussion of ... 75,76
Mechanical force, skilled, semiskilled, and unskilled employees in, number and per cent of, for a large steel plant ... 80
Mechanical repairs department, overtime work in ... 196,198
Mechanical rolling mills. (*See* Rolling mills, mechanical.)
Medical fees, deduction from wages for ... 398,399
Membership of unions ... 149–151
Merchant mill department of a representative steel plant, age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition ... 486
Middle West district, racial distribution of iron and steel employees in ... 89,90
Mixers, description of ... 48
Mud gun, description of ... 47

N.

Native and foreign-born male employees in the iron and steel industry, number and per cent of, at specified periods, 1880 to 1908 ... 91
Native and foreign-born male employees, per cent of, by principal industries, 1907–8 ... 83
Native-born employees in a large steel plant, number and per cent of, who are skilled, semiskilled, and unskilled, by conjugal condition ... 104
Nativity, per cent of male employees of each, by principal industries, 1907–8 ... 83
Negro workmen, housing of, by a steel company in the Southern district ... 435
Night shift and day shift, number of employees on, in a representative steel plant in Pittsburgh district working turns of specified hours, July 28 to 30, 1911, by departments ... 533–535
Night work, relation of, to productive efficiency ... 383,384
Nonproductive occupations, overtime work in ... 196,198
Nonunion workmen, attitude of Amalgamated Association toward ... 154–156

O.

Open-hearth furnaces:
  Age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition ... 482,483
  Bonus plan in ... 412–414
  Days in operation, production, average number of employees, and average and relative output per employee per day in, 1895 to 1910 ... 352
  Description of ... 50–54
  Earnings, annual, opportunities for, in ... 222,225,226,562,567,572
  Earnings, hourly, of employees in, classified, 1900, 1905, and 1910 ... 243
  Earnings, hourly, of employees in, compared for Steel Corporation, large independent companies, and small companies ... 264
  Employees earning each classified weekly amount in, by districts ... 553
  Employees, skilled, semiskilled, and unskilled, in, number and per cent of, for a large steel plant. 80
  English and American conditions in, compared ... 355
  Intensity of work and actual working time in ... 354,355
  Operating time in, per cent of employees according to ... 213
  Overtime work in ... 196–198

Open-hearth furnaces—Concluded. Page.
- Production of steel in, 1865 to 1910 34
- Productive efficiency in, increases in 352-354
- Steel ingots and castings, production of, by States, 1910 477
- Temperature conditions in 306-317
- Tonnage rates, average earnings, and output of tonnage workers in, 1900, 1905, and 1910 .... 577, 578
- Tonnage rates, relative (1905 and 1910 compared with 1900), of employees in occupations paid less than $3 per turn and in those paid $3 and over per turn in, 1900 256
- Tonnage workers, relative output, tonnage rates, and earnings of, 1900, 1905, and 1910 254
- Weeks of operation of, classified, and number of employees affected 549

Operating time, distribution of, in 8-inch and 10-inch rolling mills 369
Operating time, distribution of, in 38-inch and 40-inch reversing blooming mills, May 12 to 27, 1911. 362
Operation, continuous. (*See* Continuous operation.)
Operation, weeks of, in principal departments, per cent of employees according to, 1910 213
Opportunities for annual earnings. (*See* Earnings, annual.)
Opportunities for employment, effect of expansion of industry on 31, 32
Opportunities for employment in the iron and steel industry during 1910 .... 212-214, 548, 549
Organization and extent of the iron and steel industry 27-40
Organization of a large steel plant, diagram showing 56
Organizations, labor, prior to formation of the Steel Corporation 111-116
Organizations, labor, under the Steel Corporation, 1902 to 1911 116-136
Output, average daily, per month, of coke and anthracite pig iron in the United States, 1907 to 1911. 207
Output of tonnage workers, tonnage rates, and average earnings in representative plants, 1900, 1905, and 1910 576-581
Output per employee, per day and per turn in rolling mills, 1903 to 1910 .... 364, 365
Output per employee, per day, average and relative—
- Bessemer converters, 1890 to 1910 347
- Blast furnaces, 1890 to 1910 339
- Docks, 1900 to 1910 341
- Open-hearth department, 1895 to 1910 352
- Plate mill, 1895 to 1910 360
- Rail mill, 1890 to 1910 359

Output per employee, per year, average and relative, in blast furnaces, steel works, and rolling mills in specified years, 1869 to 1909 336
Output, tonnage rates, and earnings of tonnage workers, 1900 to 1910 252-258
Overtime work—
- Employees in the power, mechanical, and yard force receiving other than the regular rate for, number and per cent of, by districts 200, 201
- Extreme cases of 201, 202
- Frequency and amount of 195-198
- On Sunday 20, 21, 198, 199
- Payment for 199-201

P.

Pay-roll period, length of time between beginning of, and date payment of wages is actually made, by districts 390
Pension fund of United States Steel Corporation and subsidiary companies 455-459
Pension system of Wisconsin Steel Co 459-461
"Petty graft" of foremen 147-149
Pig-casting machine, description of 47, 48
Pig iron—
- Bessemer, fluctuations in monthly price of, at Pittsburgh, 1902 to 1911 184
- Bessemer, labor cost of, per gross ton, 1902-1906 and 1910 compared 233
- Fluctuation in production of 207
- Output per month of, in the United States, average daily, 1907 to 1911 207
- Price per ton of, average selling, increase in, required in changing from 12-hour to 8-hour system. 178, 183, 184
- Production, distribution of, by States, 1910 .... 475, 476
- Production of, 1860 to 1910 33-35
- Productive capacity for, in United States in 1912 209

Pipe mills, bonus plan in 410
Pitmen, temperature conditions of 306
Plans for elimination of 7-day work 15-20, 541-547
Plants, number of, covered by the report 13
Plate and slabbing mills, description of 64-66
Plate mills—
- Age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition 485
- Days in operation, production, average number of employees, and average and relative output per employee per day in, 1895 to 1910 360
- Earnings, hourly, of employees in, compared for Steel Corporation, large independent companies, and small companies 264
- Employees, skilled, semiskilled, and unskilled in, number and per cent of, for a large steel plant. 80
- Productive occupations in, character and severity of work in, 1895 and 1910 515-522
- Temperature conditions to which workmen are exposed during particular operations in 327

Plates and sheets, production of, 1885 to 1910 35
Platform men and ladle men, temperature conditions of 305, 306
Power, mechanical, and yard force, employees earning each classified amount in, number and per cent of, by districts 558
Power, mechanical, and yard force, overtime work of 196, 198
Prices of food, relative (weighted), 1900 to 1910 232
Prices per ton, average selling, increase in, required in changing from 12-hour to 8-hour system—
- Four principal products 181, 185
- Pig iron 178, 183, 184

Producing departments, list of 29
Production and mechanical force, difference in working condition of 79-83
Production, cost of. (*See* Cost of production.)
Production force, skilled, semiskilled, and unskilled employees in, number and per cent of, for a large steel plant 80
Production, increase in, and changes in character of products 33-38

Page.

- Production methods, effect of changes in, on labor conditions.... 37
- Production of iron and steel, by kind of product, 1860 to 1910.... 33.34
- Production of iron and steel, distribution of, by States.... 475–478
- Production of pig iron, fluctuation in.... 207
- Production of specified articles of rolled iron and steel in 1910.... 38
- Productive capacity for pig iron in the United States in 1912.... 209
- Productive occupations, character and severity of work in, 1895 and 1910.... 510–532
- Productive occupations, overtime work in.... 196, 197
- Products, value of, of blast furnaces and of steel works and rolling mills. 1899, 1904, and 1909.... 31–33
- Profit-sharing plan of United States Steel Corporation.... 463–469
- Profit-sharing plan of Youngstown Sheet & Tube Co.... 462, 463
- Profits and costs, relation of wages to.... 269–286
- Profits and expenses of Republic Iron & Steel Co., 1906 to 1911.... 278
- Profits, expenses, and receipts of United States Steel Corporation, 1902 to 1911.... 272
- Profits of company stores, Union Supply Co. of Carnegie Steel Co.... 449, 450
- Puddling and crucible furnaces, number and per cent of employees earning each classified amount in, by districts.... 554, 555
- Puddling mills, temperature conditions to which workmen are exposed during particular operations in.... 318, 319

R.

- Race—
    - Composition of labor force, by.... 83–93
    - Conjugal condition of male employees of each specified.... 102
    - Displacement of certain races in labor force during the last 30 years.... 90–93
    - Distribution of employees by, and by principal districts.... 89, 90
    - Employees of each specified, in the United States, per cent of, each specified number of years.... 93
    - Employees of each specified, per cent of, employed in specified class of industry before coming to the United States.... 101, 102
    - Employees of specified ages, classified by.... 97, 98
    - Households, per cent of, of each specified number of persons by nativity and race of head of household.... 103
    - Of skilled steel workers.... 80, 81
- Race. (*See also* Country of birth.)
- Rail ingots and heavy rails, Bessemer, labor cost of, per gross ton, 1902–1906 and 1910, compared.... 233
- Rail mill, average number of employees, days in operation, production, and average and relative output per employee per day in, 1890 to 1910.... 359
- Rail, structural, and other shape mills, description of.... 62, 63
- Rails, iron and steel, production of, 1860 to 1910.... 35
- Receipts, expenses, and profits of the United States Steel Corporation, 1902 to 1911.... 272
- Relations of employers and workmen.... 107–156
- Rent per month and description of houses maintained by steel companies in the Eastern and Pittsburgh districts.... 422–432
- Repair department, overtime work in.... 196. 198
- Republic Iron & Steel Co., expenses and profits of, 1906 to 1911.... 278
- Rod mills—
    - Description of.... 72–74
    - Earnings, hourly, in, classified, 1900, 1905, and 1910.... 248, 249
    - Tonnage rates, average earnings, and output of tonnage workers in, 1900, 1905, and 1910.... 580, 581
    - Tonnage rates, relative (1905 and 1910 compared with 1900), of employees in occupations paid less than $3 per turn and in those paid $3 and over per turn in 1900.... 256
    - Tonnage workers in, relative output, tonnage rates, and earnings of, 1900, 1905, and 1910.... 254
- Rods, wire, production of, 1885 to 1910.... 35
- Rolled iron and steel, production of specified articles of, in 1910.... 38
- Rolled iron and steel products, distribution of, by States, 1910.... 478
- Rolled iron, finished (puddled iron), production of, 1860 to 1910.... 35.36
- Rolling crew, temperature conditions of, in blooming and slabbing mills.... 321
- Rolling mills—
    - Bonus plan in, and in steel works.... 409
    - Description of.... 55–74
    - Fluctuation of employment in, and in steel works, 1905 to 1910.... 210–212
    - Productive efficiency, test of, in small.... 369
    - Temperature conditions in.... 319–332
- Rolling mills, hand—
    - Days in operation, total production, and output per day and per employee per turn in, 1903 to 1910.... 364, 365
    - Description of.... 66–74
    - Earnings, annual, opportunities for, in.... 222, 227, 228, 563, 564, 569, 573
    - Employees earning each classified weekly amount in, number and per cent of, by districts.... 556
    - Operating time in, per cent of employees according to.... 213
    - Overtime work in.... 196–198
    - Productive efficiency in, increases in.... 363–372
    - Weeks of operation of, classified, and number of employees affected.... 549
- Rolling mills, mechanical—
    - Description of.... 58–66
    - Earnings, annual, opportunities for, in.... 222, 227, 563, 568, 572, 573
    - Employees earning each classified weekly amount in, number and per cent of, by districts.... 555
    - Intensity of work and actual working time in.... 360–362
    - Operating time in, per cent of employees according to.... 213
    - Overtime work in.... 196–198
    - Productive efficiency in, increases in.... 356–360
    - Weeks of operation of, classified, and number of employees affected.... 549
- Rolling mills, steel works, and blast furnaces. (*See* Blast furnaces, steel works, and rolling mills.)

S.

- Salary, per cent of annual, allowed to be subscribed for stock in United States Steel Corporation.... 466
- Sanitation, community, in steel towns.... 471, 472
- Sanitation plant, improvement of, in steel mills.... 469–471
- Schemes for elimination of 7-day work.... 541–547

Page.

- Scope and method of the report.......... 13,14
- Semiskilled employees—
  - Age, years of service nativity, and conjugal condition of, by departments.......... 480–493
  - Characteristics of.......... 81,235
  - Conjugal condition and nativity of.......... 104
  - Country of birth of.......... 88
  - Definition of.......... 80
  - Number and per cent of, by departments.......... 80 81
- Seven-day week and 12-hour day, plans for elimination of.......... 15–20, 157–192, 541–547
- Seven-day week, attitude of workmen toward elimination of.......... 16
- Severity of the work and speed, working conditions and efficiency as affected by.......... 333–376
- Severity of the work in productive occupations in 1895 and 1910.......... 510–532
- Shanties of unskilled workmen provided by a steel company in the Eastern district.......... 423–426
- Shape mills, description and discussion of.......... 62.63
- Shearmen and helpers, temperature conditions of, in blooming and slabbing mills.......... 322.323
- Sheet bar and billet mills, description of.......... 63.64
- Shifting character of labor force, relation of, to productive efficiency.......... 379–381
- Shipping department and mill yards of a representative steel plant, age and years of service in iron and steel industry of workmen in, by skill, nativity and conjugal condition.......... 492
- Shops, overtime work in.......... 196. 198
- Skelp mills, bonus plan in.......... 409. 410
- Skilled employees—
  - Age, years of service, nativity and conjugal condition of, by departments.......... 480–493
  - Characteristics of.......... 80, 81, 235
  - Conjugal condition and nativity of.......... 104, 105
  - Country of birth of.......... 88
  - Definition of.......... 80
  - Housing of, and of officials, by a steel company in the Eastern district.......... 421–423
  - Number and per cent of, by departments.......... 80. 81
- Slabbing and plate mills, description of.......... 64–66
- Slabbing mills, temperature conditions to which workmen are exposed during particular operations in.......... 325
- Slag disposal, stove cleaning, and boiler rooms, temperature conditions in.......... 300, 301
- Sliding scale.......... 153, 154, 462
- Soaking pits, description and discussion of.......... 59
- Sons of Vulcan.......... 111, 112, 129, 130, 136, 144
- Southern district, racial distribution of iron and steel employees in.......... 89, 90
- Speed and severity of the work, working conditions and efficiency as affected by.......... 333–376
- Steam department of a representative steel plant, age and years of service in iron and steel industry of workmen in, by skill, nativity, and conjugal condition.......... 487
- Steel and pig iron, production of, 1860 to 1910.......... 33–38
- Steel and rolled iron, production of specified articles of, in 1910.......... 38
- Steel Corporation, United States. (*See* United States Steel Corporation.)
- Steel works—
  - Bonus plan in, and in rolling mills.......... 409
  - Description and discussion of a modern.......... 41–76
  - Distribution of, in the United States, by size of community in which located.......... 479
  - Eight-hour system in, actual results of.......... 187–192
  - Employees, establishments, capital, and products of, 1899, 1904, and 1909.......... 31–33
  - Fluctuations in employment in, and in rolling mills.......... 210–212
  - Organization of, diagram showing.......... 56
  - Output, average and relative, per employee in, and in rolling mills, in specified years, 1869 to 1909. 336
- Steel works, rolling mills, and blast furnaces. (*See* Blast furnaces, steel works, and rolling mills.)
- Stock-subscription plan of United States Steel Corporation.......... 464–469, 582–584
- Store orders, purchase and sale of.......... 393, 394
- Stores, company, dividends and balance sheet of Union Supply Co. of Carnegie Steel Co.......... 449, 450
- Stove cleaning, boiler rooms, and slag disposal, temperature conditions in.......... 300, 301
- Strike of 1901, history and discussion of.......... 120–129
- Strike of organized workmen in puddling and iron rolling mills, 1882.......... 112
- Strikes in Homestead steel works.......... 115, 116
- Structural mills, age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition.......... 484
- Structural mills, skilled, semiskilled, and unskilled employees in, number and per cent of, for a large steel plant.......... 80
- Structural, rail, and other shape mills, description of.......... 62, 63
- Structural shapes, production of, 1895 to 1910.......... 35
- Sunday day shift, employees whose positions are required to be occupied during, by departments.. 537, 538
- Sunday duty, employees who report for, previous to their regular shift, by departments, occupations, and time worked.......... 539, 540
- Sunday overtime work.......... 20, 21, 198, 199
- Supervisory and clerical employees, age and years of service in steel industry of, by nativity and conjugal condition.......... 494–496
- Surplus, undivided, of Republic Iron & Steel Co. after payment of dividends, 1906 to 1911.......... 279
- Surplus, undivided, of United States Steel Corporation after payment of dividends, 1902 to 1911.... 274, 277

T.

- Temperature conditions in blast furnaces, steel works, and rolling mills.......... 292–332
- Tonnage, increase in, in a large tube mill, 1901 to 1910.......... 375
- Tonnage rates, average earnings, and output of tonnage workers in representative plants, 1900, 1905, and 1910.......... 576–581
- Tonnage rates, earnings, and output of tonnage workers, 1900 to 1910.......... 252–268
- Tonnage rates, relative (1905 and 1910 compared with 1900), of employees in occupations paid less than $3 per turn and in those paid $3 and over per turn in 1900, by departments and plants...... 256
- Top fillers, temperature conditions of.......... 297, 298
- Transportation department, age and years of service in steel industry of workmen in, by skill, nativity, and conjugal condition.......... 489

Page.

- Tube mills—
  - Bonus plan in, 411, 412
  - Employees earning each classified amount in, by districts, 557
  - Productive efficiency in, increases in, 375, 376
  - Productive occupations in, character and severity of work in, 1895 and 1910, 522–532
  - Temperature conditions to which workmen are exposed during particular operations in, 330–332
- Twelve-hour work, plans for elimination of, 171–175

U.

- Unemployment in iron and steel industry, effect of, 214
- Unemployment. (*See also* Irregularity of employment; Operating time; Opportunities.)
- Union Supply Co. of Carnegie Steel Co., dividends of, and balance sheet of, 449, 450
- Union workmen and employers, relations of, 149–156
- United States Steel and Carnegie Pension Fund, 455–459
- United States Steel Corporation—
  - Action of, during tin-plate strike of 1909, affidavits presented by American Federation of Labor regarding, 507–509
  - Attitude of, toward organized labor, 117–120
  - Bonus fund in, 464
  - Earnings of workmen in, compared with those in large independent companies and small companies, 23, 24, 259–267
  - Extracts from minutes of executive committee of, 497–506
  - Hours of labor, report of committee of stockholders and resolutions of finance committee of, regarding, 161, 162
  - Organization and extent of, 32, 33
  - Profit-sharing plan of, 463–469
  - Receipts of, from all sources, and expenses and profits of, 1902 to 1911, 272
  - Stock subscription plan of, 464–469, 582–584
  - Workmen and, present relations between, 137, 138
- Unskilled employees—
  - Age, years of service, nativity, and conjugal condition of, by departments, 480–493
  - Characteristics of, 81, 82
  - Conjugal condition and nativity of, 104, 105
  - Country of birth of, 88
  - Definition of, 80
  - Hourly wage rates of, 1901 to 1910, 251, 252
  - Housing of, by a steel company in the Eastern district, 423–426
  - Number and per cent of, in a large steel plant, by departments, 80–83
- Unsteady employment, relation of, to productive efficiency, 379–381

V.

- Vessel men, temperature conditions of, 304, 305

W.

- Wages—
  - Additions to, indirect, 404–414
  - Advances on, 392–394
  - Cost of living and, 23
  - Deductions from, 394–404
  - Hourly rates of, increase in, required in changing from 12-hour to 8-hour system in blast furnaces and in principal departments, 178, 181, 183, 185
  - Hourly rates of, 1900 to 1910, all classes of labor, 232–249
  - Hourly rates of, paid common labor, 1901 to 1910, 251, 252
  - Hourly rates of, paid common laborers in specified plants, 1901 to 1910, 574, 575
  - Inefficiency as related to low, 382, 383
  - Payments of, frequency of, for employees and plants, by districts, 388
  - Payments of, time and method of, 385–414
  - Per cent of, allowed to be subscribed for stock in United States Steel Corporation, 465
  - Profits and costs in relation to, 269–286
  - Salaries and, total, paid by Republic Iron & Steel Co., in per cent of total receipts, 1906 to 1911, 279
  - Salaries and, total, paid by United States Steel Corporation, and per cent of total receipts, 1902 to 1911, 274, 277
  - Scale of, method of fixing, 152–154
  - Time of actual payment of, as compared with beginning of pay-roll period, by districts, 390
  - Trend of, 1900 to 1910, 229–258
- White workmen, housing of, by a steel company in the Southern district, 433–435
- Wire rods, production of, 1885 to 1910, 35
- Wisconsin Steel Co., pension system of, 459–461
- Workers, skilled, unskilled, and semiskilled, characteristics of, 235
- Working conditions—
  - Causes underlying existing, 14
  - Difference in, of production and mechanical force, 79–83
  - Efficiency and, as affected by heat, 287–332
  - Efficiency and, as affected by speed and severity of the work, 333–376
- Working day, division of, into active time and idle time, in—
  - Bessemer converters, 352
  - Blast furnaces, 344
  - Mechanical rolling mills, 361
  - Open-hearth department, 355
- Working hours in a representative steel plant, detailed exhibit of, 533–540
- Working hours in 1912, 159–164
- Working time, actual, and intensity of work in—
  - Bessemer converters, 351, 352
  - Blast furnaces, 344–346
  - Mechanical rolling mills, 360–362
  - Open-hearth department, 354, 355
- Working time, per cent of actual, occupied in duties of specified character in blast furnace, 345

Page.

Workmen—
  Attitude of, toward elimination of 7-day week ... 16
  Employers and, relations of ... 107–156
  Iron and steel industry, general character of ... 14, 15
  Negro, housing of, by a steel company in the Southern district ... 435
  Nonunion, attitude of Amalgamated Association toward ... 154–156
  Per cent of salary of, allowed to be subscribed for stock in United States Steel Corporation ... 465
  Skilled, housing of, by a steel company in the Eastern district ... 421–423
  Skilled, semiskilled, and unskilled, characteristics of ... 80–82
  Steel mills, organization and character of ... 77–105
  Unskilled, hourly wage rate of, 1901 to 1910 ... 251, 252
  Unskilled, housing of, by a steel company in the Eastern district ... 423–426

Y.

Yard and transportation department, overtime work in ... 196, 198
Yard facilities in steel mills, discussion of ... 75
Yard labor, general, age and years of service in the steel industry of, by skill, nativity, and conjugal condition ... 493
Years of service in the steel industry of supervisory and clerical employees, by nativity and conjugal condition ... 494–496
Years of service in the steel industry of workmen, by skill, nativity, and conjugal condition ... 481–493
Youngstown Sheet & Tube Co., profit-sharing plan of ... 462, 463

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